News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Jim Cast
Headquarters, Washington, DC
(Phone: 202/358-1779)

April 2, 1996

Dom Amatore
Marshall Space Flight Center, Huntsville, AL
(Phone: 205/544-0031)

RELEASE: 96-62

X-33 PHASE II COOPERATIVE AGREEMENT NOTICE ISSUED

A Cooperative Agreement Notice (CAN) was issued late yesterday for demonstration of Single-Stage-To-Orbit (SSTO) technologies through the design, fabrication and flight test of an X-33 advanced technology demonstrator. This technology demonstration effort will enable the development of a new generation of reusable launch vehicles which will greatly reduce the cost of putting payloads into orbit.

"We are moving forward in our partnership with industry to do the cutting-edge research required to provide our nation with a reliable, affordable means of access to space," said Gary Payton, Reusable Launch Vehicle program manager in NASA's Office of Space Access and Technology, Washington, DC.

The notice solicits proposals for a joint government and industry effort to demonstrate SSTO technologies by means of the X-33. Three aerospace companies -- Lockheed Martin Skunk Works, McDonnell Douglas Aerospace and Rockwell International Corp. -- have been working with NASA since March 1995 on concept definition and design of the X-33 in Phase I of the program. NASA will select an industry partner for Phase II, in which X-33 will demonstrate vehicle reusability and operability concepts that assure low cost operations and rapid processing for reflight. Phase II will culminate in flight demonstration testing of the X-33, which will begin in early 1999.

"X-33 is an experimental program intended to reduce the risk of developing and operating a Single-Stage-To-Orbit vehicle," said X-33 project manager Gene Austin of NASA's Marshall Space Flight Center, Huntsville, AL.

-more-

"It will give government and industry the means to decide by the end of this decade the feasibility of developing an operational next-generation reusable launch vehicle. That development, if it occurs, is planned to be led by industry."

NASA and industry will share costs during Phase II of the X-33 program, with NASA budgeting a total of $941 million in expenditures through 1999. The amount its industry partner will invest is to be determined.

Industry proposals are due by May 13, 1996, and NASA expects to select its industry partner by July. Approval from the White House is required for NASA to proceed into this next phase of the X-33 program.

The X-33 CAN is available via the Internet at URL:

http://procure.msfc.nasa.gov/midrange/presol/notices/notices.html

- end -

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. NASA releases also are available via CompuServe using the command GO NASA.

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Rick Mould
University of Alabama, Huntsville, AL
(Phone: 205/895-6414)

RELEASE: 96-63

FIRST LAUNCH VOUCHER FLIGHT SCHEDULED

A 1,000 pound commercial research payload of eight experiments is planned for launch from the New Mexico desert on April 3. Named the Conquest 1 mission, it is the first flight under the Launch Voucher Demonstration Program.

The suborbital mission is managed by The University of Alabama in Huntsville's Consortium for Materials Development in Space (UAH CMDS). EER Systems, Seabrook, MD, will supply launch services using its Starfire rocket. Planned for launch at 10:40 a.m. EST from the White Sands Missile Range, New Mexico, the flight will provide six to eight minutes of microgravity for the experiments. The entire mission from launch to the parachute landing of the payload is approximately 15 minutes and will be supported by the range's Naval Air Warfare Center Weapons Division.

The Starfire is a two-stage, solid-fuel vehicle, which stands approximately 52 feet tall and weighs about 6,000 pounds. The vehicle will boost the payload to an altitude of nearly 200 miles into space. EER is supplying the rocket plus launch and recovery services. Payload integration is led by the UAH CMDS.

NASA provided $2 million in funding to UAH for the voucher launch. The program's goal is to stimulate the U.S. launch vehicle industry and to give researchers a more direct role in the selection of integration and launch service providers. The mission will include eight materials and biotechnology experiments supporting commercial research efforts to study the effects of microgravity on various materials, processes and biological specimens.

-more-

The UAH CMDS, one of 11 NASA Commercial Centers, proposed to NASA several payloads to fly under the voucher program. NASA awarded the voucher to UAH in 1994. UAH conducted a competitive solicitation and awarded the launch contract to EER Systems in 1995. UAH will provide an assessment of the launch voucher program to NASA as part of the demonstration project.

- end -

NOTE TO EDITORS: EER Systems, Inc., has arranged for a playback of the Conquest 1 launch, including interviews, to be broadcast via satellite on Wednesday, April 3 at 3 p.m. EST. Satellite coordinates are SBS 6, Transponder 10 Full, Frequency 11.946.

For further payload and launch accreditation information, contact:

Rick Mould - UAH 205/895-6414
email: mouldr@email.uah.edu

Mike Bryant - EER 301/577-8900
bryant@eer.com

Debbie Bingham - White Sands
505/678-1134
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Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

April 3, 1996

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

VIDEO ADVISORY: V96-34

COMPTON GAMMA RAY OBSERVATORY ANNIVERSARY ON NTV THURSDAY

On Thursday NASA TV will air footage and interviews commemorating the fifth anniversary of the Compton Gamma Ray Observatory (CGRO), the second of NASA's Great Observatories. Launched April 7, 1991, the Compton is conducting an all-sky gamma ray mapping of the universe. Compton also is conducting gamma ray astronomy studies of black holes. International participation in the observatory includes Germany, the Netherlands, the United Kingdom and the European Space Agency.

ITEM #1: CGRO TURNS FIVE

File footage of launch and deploy of the Compton Gamma Ray Observatory in celebration of it's fifth anniversary.

ITEM #2: INTERVIEW -- NEIL GEHRELS, PROJECT MANAGER, CGRO

Gehrels discusses the accomplishments of the Observatory.

Video news files air daily at noon, 3, 6 and 9 p.m. EST.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
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Michael Braukus
Headquarters, Washington, DC
(Phone: 202/358-1979)

For Release

April 4, 1996

RELEASE: 96-64

TRAINEES SELECTED FOR SHUTTLE NEUROLAB MISSION

NASA has selected Dr. Jay C. Buckey, Dr. Alexander W. Dunlap, Dr. Chiaki Mukai and Dr. James A. Pawelczyk to train as payload specialists for the 16-day Neurolab mission.

Neurolab, dedicated to research on the nervous system and behavior, is scheduled for launch on the Space Shuttle Columbia in early 1998. The mission is a joint venture of six space agencies and seven U.S. research agencies. Investigator teams from nine countries will conduct 31 studies in the microgravity environment of space.

Buckey, 39, earned a doctor of medicine degree from Cornell University Medical College, Ithaca, NY. He is a resident and instructor in medicine at the Dartmouth-Hitchcock Medical Center, Lebanon, NH. Buckey was an alternate payload specialist for STS-58, the second Spacelab life sciences mission.

Dunlap, 35, received his doctor of veterinary medicine degree from the Louisiana State University School of Veterinary Medicine, Baton Rouge, LA. He will receive a doctor of medicine degree at the University of Tennessee College of Medicine, Memphis, TN in May 1996.

Mukai, 43, an astronaut with the National Space Development Agency of Japan, earned a doctor of medicine degree and a doctor of philosophy degree in physiology from the Keio University School of Medicine, Tokyo, Japan. Mukai became the first Japanese woman to fly in space when she flew as a payload specialist on STS-65, the second International Microgravity Laboratory mission in 1994.

Pawelczyk, 35, received a doctor of philosophy degree in biology from the University of North Texas, Denton, TX. He is an assistant professor of applied physiology at Penn State University, University Park, PA.

- more -

Although four candidates have been selected to train as payload specialists, only two will fly on the mission. The remaining two will serve as backups, or alternates, and will be ready to serve on the mission crew if necessary. The final selection will be made approximately a year before launch.

- end -

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For Release

April 4, 1996

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RELEASE: 96-65

THE COMPTON GAMMA RAY OBSERVATORY MARKS FIVE YEARS IN SPACE

NASA's Compton Gamma Ray Observatory marks its five year anniversary April 5. Launched in 1991 from the Space Shuttle Atlantis, the Compton Observatory is the second in a series of Great Observatories and is the heaviest spacecraft ever deployed by a Shuttle.

The spacecraft, named for American Nobel Prize-winning physicist Arthur Holly Compton, is the first satellite dedicated to making gamma ray observations across a broad spectrum of energies. Scientists believe that gamma rays, which are an invisible highly energetic form of radiation, are emitted during violent cosmic events such as supernovae, quasars, pulsars and black holes. NASA scientists are using the Compton Observatory to create a comprehensive map of celestial gamma ray sources.

"The spacecraft and instruments have been remarkably reliable, and all four instruments are performing near their design specification," said Dr. Neil Gehrels, Project Manager of the Compton Observatory at the Goddard Space Flight Center (GSFC), Greenbelt, MD. "Thus far Compton has made extraordinary discoveries, and the science team is looking forward to more discoveries as the observatory begins its sixth year in space."

-more-

While tape recorders on the observatory failed early in the mission, their failure turned out to be an unexpected scientific bonus. Instead of storing data on the spacecraft and retrieving it every four hours, scientists can now receive a 24-hour-a-day stream of data in real time. This allows scientists to quickly begin monitoring outbursts of energy, such as on Jan. 31, 1993, when the satellite detected the highest energy gamma rays ever seen in a burst, an event dubbed the "Super Bowl Burst." In December 1995, the Compton Observatory detected the sudden appearance of a never-before-seen type of object which bursts and pulses at the same time. This bursting pulsar is currently the brightest source of gamma rays and X-rays in the sky.

Among the Compton Observatory's most significant discoveries:

- Gamma ray bursts are evenly distributed across the sky, which suggests that gamma rays are coming from the farthest reaches of space and not just from our own Milky Way galaxy, as astronomers once believed;

- Gamma ray quasars, a new class of high-energy gamma ray sources, in active galactic nuclei, the bright and active central cores of some galaxies;

- A source of gamma rays and X-rays that exhibits the behavior of both a pulsar and a burster;

- Gamma ray bursts and solar flares are accompanied not only by a release of low-energy gamma rays over a relatively short period of time (tenths of seconds to seconds) but also by a release of high energy gamma rays over a longer period of time;

- Gamma-ray emitting active galactic nuclei, known as Seyfert galaxies, emit most of their gamma-rays at lower energies than previously thought. This is important evidence that such objects may be the source of diffuse gamma rays;

- A threefold increase, from two to six, in the number of pulsars known to emit gamma rays (pulsars are rotating neutron stars that spin very rapidly and produce beams of radio energy that appear to flash on and off), among more than 500 known radio pulsars. This gives astronomers a greater opportunity to understand why some pulsars emit gamma rays and others do not;

- The first detection of the presence and nuclear decay of cobalt 57, an isotope of cobalt thought to have been created during the explosion of a star known as Supernova 1987A. This detection helps confirm the nucleosynthesis theory of how elements heavier than hydrogen and helium are formed and distributed in our galaxy via the evolution of stars;

- That the energy created by the mutual destruction of electrons and positrons in our galaxy is concentrated in a bulge around the center of the galaxy, with a second component extending out along the plane of our galaxy;

- The first mapping of the distribution of a radioactive isotope called Aluminum 26 within the Milky Way Galaxy. The instruments on CGRO detect the isotope by measuring gamma ray energy associated with its radioactive decay. Scientists believe that this energy distribution, which has proven to be "patchy" rather than smooth, holds clues to understanding nucleosynthesis in our galaxy;

- The detection of the gamma ray energy given off by interactions between cosmic rays and carbon 12 and oxygen 16 nuclei. The energy "signature" associated with the excitation of these molecules and subsequent emission of gamma rays help scientists identify the types of matter and nuclear processes occurring within the region of the Milky Way galaxy known as the Orion Arm.

The Compton Observatory is currently in a circular, 240-mile-high orbit inclined 28.5 degrees to the equator. NASA is considering reboosting the 17-ton, low-Earth-orbiting satellite to a higher orbit that would allow the spacecraft to continue to track the gamma ray universe well into the next century.

"The Compton Observatory has vastly increased our understanding of some of the most violent events in the universe," said Compton Program Manager Dr. Alan Bunner. "We have every reason to believe we will continue to be amazed by its discoveries in the future."

The Compton Observatory is managed for NASA's Office of Space Science, Washington, DC.

Information on the spacecraft is available on the Internet at:
http://enemy.gsfc.nasa.gov/cossc/cgro.html

- end -

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For Release

April 4, 1996

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RELEASE: 96-66

FIRST X-RAYS FROM A COMET DISCOVERED

A team of U.S. and German astrophysicists have made the first ever detection of X-rays coming from a comet.

The discovery of a strong radiation signal -- about 100 times brighter than even the most optimistic predictions -- was made March 27, 1996, during observations of comet Hyakutake using Germany's orbiting ROSAT satellite.

"It was a thrilling moment when the X-rays from the comet appeared on our screen at the ROSAT ground station," said Dr. Konrad Dennerl of the Max Planck Institute for Extraterrestrial Physics (MPE), Garching, Germany. Following the initial detection, the team reported repeated X-ray emissions from the comet over the next 24 hours. The comet was near its closest approach to the Earth at a distance of less than 10 million miles when it was first detected by ROSAT.

The strength and rapid changes in intensity of the comet's X-ray emission both surprised and puzzled astronomers.

"We had no clear expectation that comets shine in X-rays," said Dr. Michael J. Mumma of NASA's Goddard Space Flight Center, Greenbelt, MD. "Now we have our work cut out for us in explaining these data, but that's the kind of problem you love to have."

The comet was examined repeatedly during March 26-27 as it swept across the sky. The German scientists were able to correct satellite attitude for the comet's motion during each observation, and produce accurate images with the aid of a computer.

- more -

X-rays have never been found from a comet before, and scientists had optimistically predicted an intensity that turned out to be about 100 times weaker than the radiation actually detected by ROSAT. Strong changes in the brightness of the X-rays were another surprise. There were pronounced increases and decreases in the X-ray brightness from one ROSAT observation to another, typically over a time difference of a few hours.

Still another puzzle is the nature of the physical process that generates the X-rays, but the ROSAT image may contain clues to this process. In the image, the X-rays from the comet seem to come from a crescent-shaped region on the sunward side of Comet Hyakutake.

Explaining the unexpected bright X-ray emission is the next major task for the science team. One preliminary theory is that X-ray emission from the Sun was absorbed by a cloud of gaseous water molecules surrounding the nucleus of the comet, and then were re-emitted by the molecules in a process physicists call "fluorescence."

According to this idea, the cloud is so thick that its sunward side absorbs nearly all the incoming solar X-rays, so that none reach the remainder of the cloud. This could explain why the cometary X-ray emission has the form of a crescent, rather than that of a sphere around the nucleus.

A second possible explanation is that the X-rays are produced from the violent collision between the comet material and the supersonic "wind" of plasma and particles streaming away from the Sun.

"We always learn something new when we study an object at different wavelengths," commented Dr. Carey M. Lisse of Goddard, the leader of the X-ray investigation. "Now we have to determine why the comet is so bright in X-rays, and see what we can learn about its structure and composition from these unique images."

- end -

NOTE TO EDITORS: A ROSAT image of Comet Hyakutake to accompany this release is available to news media representatives by calling the Imaging Branch on 202/358-1900. Photo numbers are:

B&W: 96-H-214
Color: 96-HC-214

The image also is available on the Internet at URLs:

http://www.rosat.mpe-garching.mpg.de/~jer/rda/comet/
or
http://heasarc.gsfc.nasa.gov/docs/rosat/hyakutake.html

News Release

National Aeronautics and
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Washington, DC 20546
(202) 358-1600

For Release

April 8, 1996

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NOTE TO EDITORS: N96-24

LUCID, CREWMATES TO HOLD NEWS CONFERENCE ABOARD MIR

U.S. astronaut Shannon Lucid and her crewmates will hold a news conference aboard the Russian space station Mir on Thursday, April 11 at 11:05 a.m. EDT to discuss the progress of their long duration scientific research flight.

Lucid, Mir 21 Commander Yuri Onufrienko and Flight Engineer Yuri Usachev will answer questions from U.S. reporters during the 30-minute news conference, which will be seen on NASA Television with translation provided. Reporters will be able to ask questions from participating NASA centers.

Lucid joined her Mir 21 colleagues on March 23 following the docking of Atlantis to the Mir during the STS-76 mission. Lucid will remain on board the Russian space station until early August, when she will be replaced by U.S. astronaut John Blaha, who will be launched as part of the STS-79 crew. Onufrienko and Usachev will be replaced aboard the Mir by another cosmonaut crew in July, which will include a French researcher.

NASA Television is located on Spacenet 2, Transponder 5, Channel 9 at 69 degrees West longitude. The transponder frequency is 3880 Mhz and the audio subcarrier is 6.8 Mhz. Polarization is horizontal.

-end-

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

April 9, 1996

VIDEO ADVISORY: V96-35

ANTI-SHOCK TROUSERS FEATURED ON NASA TV WEDNESDAY

On Wednesday NASA TV will air footage and interviews highlighting space technology developed by NASA that has become a vital safety "spinoff" used to combat internal bleeding in emergency situations. The "Shock Trousers" are an adaptation of the anti-gravity flight suits originally developed for pilots and astronauts that emergency rescue workers now use to stop internal bleeding among accident victims. The trousers are among items to be inducted into the United States Space Foundation's "Technology Hall of Fame" on Thursday.

ITEM #1: ANTI-SHOCK TROUSERS
Anti-gravity flight suit technology used in emergency care.

ITEM #2: INTERVIEW -- DR. RALPH PELLIGRA, AMES RESEARCH CENTER
Pelligra discusses the anti-shock trousers.

ITEM #3: INTERVIEW -- DR. BRUCE WEBBON
Webbon discusses the relationship between anti-shock trousers and anti-gravity suits.

Video news files air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

Video Advisory

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Headquarters, Washington, DC
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For Release

April 10, 1996

VIDEO ADVISORY: V96-36

MIR SPACE STATION PRESS CONFERENCE THURSDAY

On Thursday at 11:05 a.m. EDT there will be a live press conference from the Russian Mir space station featuring American astronaut Shannon Lucid. Lucid joined the Mir crew in March and will be part of the space station crew for five months. The press conference, scheduled to last approximately 35 minutes, will be replayed at the end of the daily video news files.

Replaying Thursday will be footage and interviews highlighting space technology developed by NASA that has become a vital safety "spinoff" used to combat internal bleeding in emergency situations. The "Shock Trousers" are an adaptation of the anti-gravity flight suits originally developed for pilots and astronauts that emergency rescue workers now use to stop internal bleeding among accident victims. The trousers are among items to be inducted into the United States Space Foundation's "Technology Hall of Fame" on Thursday.

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Anti-gravity flight suit technology used in emergency care.

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Webbon discusses the relationship between anti-shock trousers and anti-gravity suits.

ITEM #4: INTERVIEW -- H.C. VYKUKAL
Vykukal explains the function of the anti-shock trousers.

ITEM #5: MIR PRESS CONFERENCE REPLAY

Video news files air daily at noon, 3, 6 and 9 p.m. EDT.

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-end-

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For Release

April 10, 1996

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RELEASE: 96-67

ADVANCED LAND IMAGER PICKED FOR FIRST NEW MILLENNIUM EARTH SCIENCE FLIGHT

An advanced, lightweight scientific instrument designed to produce visible and short-wave infrared images of Earth's land surfaces has been selected as the focus of the first NASA New Millennium program mission dedicated to the agency's Mission to Planet Earth enterprise.

The capabilities of the Advanced Land Imager instrument to be demonstrated on the flight will serve multiple purposes, according to Dr. Charles Kennel, NASA Associate Administrator for Mission to Planet Earth.

The new instrument will demonstrate remote-sensing measurements of the Earth consistent with data collected since 1972 through the Landsat series of satellites, which is used by farmers, foresters, geologists, economists, city planners and others for resource monitoring and assessment. In addition, it will acquire data with finer spectral resolution, a capability long sought by many elements of the Earth observation data user community, and it will lay the technological groundwork for future land imaging instruments to be more compact and less costly.

"We looked at nearly a dozen different mission concepts in some detail, and a land surface imaging mission clearly was at the top of this year's priority list," Kennel said. "It will ultimately enable first-class science, by validating breakthrough technology with clear potential capabilities, both commercially and to the future of NASA's Earth Observing System."

-more-

As designed, the Advanced Land Imager represents an approximate sevenfold decrease in mass and electrical power usage demands compared to the current Landsat 5 multispectral instrument. In addition, it extends the existing measurement capabilities through the incorporation of an advanced high resolution hyperspectral imaging "spectrometer-on-a-chip." This novel, wide-field observing system requires no scan mirror. It is built around a lightweight integrated silicon carbide structure and optical system, with an innovative in-flight calibration system.

Under project management by the Goddard Space Flight Center, Greenbelt, MD, the Advanced Land Imager will be developed from instrument technologies proposed by members of the existing New Millennium Integrated Product Development Teams.

For this mission, the team of industry partners will be led by the Massachusetts Institute of Technology's Lincoln Laboratory, Lexington, MA, a federally funded research and development center. Lincoln Lab and its partners will provide open access to U. S. industry regarding the design and performance of the Advanced Land Imager, with the explicit purpose of expediting the transfer of this technology into the commercial sector.

The instrument will feature ten-meter ground resolution in the panchromatic (black-and-white) band and 30-meter ground resolution in its other spectral bands, using a four-chip multispectral focal plane array that covers seven of the eight bands of the current Landsat. Hyperspectral capabilities, which further split these bands into highly differentiated images, will be tested to show that they can be combined into traditional Landsat-equivalent data sets.

"The combination of multispectral and hyperspectral capabilities in a future operational system would preserve and continue the invaluable Landsat-based record of global land cover change, while opening up new windows on the Earth in areas like precision vegetation studies and more accurate mineral identification," Kennel said.

The spacecraft support structure, including advanced electrical power and data-handling subsystems, will be provided by Swales & Associates, Inc., Beltsville, MD, and Litton Industries, College Park, MD. The effort also will incorporate advanced spacecraft technologies made available through the New Millennium Integrated Product Development Teams.

The power and data subsystems will be provided through a Space Act cost-sharing agreement that calls for Litton to develop the hardware and integrate it into the New Millennium spacecraft, while providing the company

with a two-year license to commercialize the technology. "This innovative arrangement, which includes a major commitment from Litton to integrate and deliver the hardware, represents an exciting new way of doing business for Goddard," said Center Director Joseph Rothenberg.

Further potential industry partnerships in the mission beyond those already identified will be solicited in a workshop to be held during upcoming advanced definition studies.

The total NASA cost of the first New Millennium Earth science mission, including its Small Expendable Launch Vehicle, has been capped at $90 million. Launch is planned for late 1998.

The current mission operations concept for the New Millennium flight has the spacecraft flying autonomously several minutes ahead of the ground track flown by the planned Landsat 7 satellite, to provide accurate paired-scene comparisons between the new and the traditional observing technologies. Evolutionary versions of the Advanced Land Imager would be candidates for flight on future generations of NASA Earth Observing System missions, beginning with the AM-2 spacecraft.

Formally started in NASA's FY 1996 budget, the goal of the New Millennium program is to identify, develop, and flight-validate key instrument and spacecraft technologies that can enable new or more cost-effective approaches to conducting science missions in the 21st century. The overall program is managed by the Jet Propulsion Laboratory, Pasadena, CA, for NASA's Office of Space Science, Office of Space Access and Technology, and Office of Mission to Planet Earth, Washington, DC.

An artist's rendering of the spacecraft, in GIF and JPEG formats, may be accessed through the Internet. Via the World Wide Web, use the URLs:

http://www.hq.nasa.gov/office/pao/images/ali.gif
http://www.hq.nasa.gov/office/pao/images/ali.jpg

Via FTP, log on to ftp.hq.nasa.gov as anonymous and go to the directory /pub/pao/images.

-end-

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RELEASE NO: 96-68

INVESTIGATIONS SELECTED FOR INITIAL MIDEX MISSIONS

NASA's Office of Space Science has selected the first two science missions for the new Medium-class Explorer (MIDEX) program. The two missions, selected for definition studies leading to confirmation and development, are the Microwave Anisotropy Probe (MAP) and the Imager for Magnetopause-to-Aurora Global Exploration (IMAGE).

The MAP mission will make a detailed investigation of the cosmic microwave background to help understand the large scale structure of the universe, such as galaxies and clusters of galaxies, which result in enormous walls and voids in the cosmos. The Principal Investigator is Dr. Charles L. Bennett of the Goddard Space Flight Center, Greenbelt, MD. Information about the MAP mission is available on the World Wide Web at URL: http://map.gsfc.nasa.gov.

The IMAGE mission will use three-dimensional imaging techniques to study the global response of the Earth's magnetosphere to variations in the solar wind, the steam of electrified particles flowing out from the Sun. The magnetosphere is the region surrounding the Earth controlled by its magnetic field and containing the Van Allen radiation belts and other energetic charged particles. The IMAGE Principal Investigator is Dr. James L. Burch, Southwest Research Institute, San Antonio, TX.

"These selections are the beginning of a key component of our program of scientific exploration of space into the next century," said Dr. Wesley T. Huntress Jr., Associate Administrator for Space Science at NASA Headquarters, Washington, DC. "We received many outstanding proposals for the first two MIDEX missions, and it was an extremely difficult choice. It's exciting that such remarkable science can be accomplished within the MIDEX cost constraints."

- more -

In addition to the two primary missions, two alternate missions were chosen to receive minimal funding for study in the event that the primary missions are not able to proceed to development. The alternate mission for MAP is The Hopkins Ultraviolet Background Explorer (HUBE). Dr. Richard Henry, Johns Hopkins University, is Principal Investigator. The alternate for IMAGE is the High Energy Solar Spectroscopic Imager (HESSI). Professor Robert Lin, University of California, Berkeley, is Principal Investigator.

The MIDEX program is intended to provide research opportunities in the areas of astrophysics and space physics. Plans call for about one MIDEX mission to be launched per year, with development cost capped at no more than $70 million (FY 1994 dollars) each, excluding the costs of the launch vehicle and mission operations and data analysis. Mission operations are expected to be completed within two years.

The space science investigations in the MIDEX program will use spacecraft launched on NASA's Med-Lite expendable launch vehicles, with launch anticipated to be late 1999 and 2000. The launch dates and order of launch will be determined in the near future, followed by confirmation for development of the first mission in about a year.

The MIDEX missions are a new component of NASA's Explorer program, designed to complement the Small Explorer and the proposed University Explorer Programs, and are a follow-on to the more than 70 successful missions beginning with the launch of Explorer 1 in 1958. The Explorer program was restructured in 1994 to permit more frequent, low-cost launch opportunities, with no more than three years from the design and development phase to launch.

The Explorer Project Office at the Goddard Space Flight Center will manage MIDEX mission development for NASA's Office of Space Science, Washington, DC. The Med-Lite Expendable Launch Vehicle program is managed by Goddard's Orbital Launch Project Office. McDonnell Douglas Aircraft Company will provide the Med-Lite launch vehicle.

- end -

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

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Headquarters, Washington, DC
(Phone: 202/358-1779)

April 10, 1996

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RELEASE: 96-69

NASA LIFE-SAVING TECHNOLOGIES ENTER SPACE HALL OF FAME

Three technologies originally developed by NASA to improve pilot and astronaut safety will be inducted into the United States Space Foundation's "Space Technology Hall of Fame" on April 11 to honor their contribution to enhancing the quality of life on Earth.

The technologies being recognized are those for anti-shock trousers, flame retardant seat materials and the radiation barrier. Two of these technologies were developed by engineers in the Space Technology Division at the Ames Research Center, Mountain View, CA. The radiation barrier was developed for the Apollo program through the Johnson Space Center, Houston, TX. The anti-shock trousers are an adaptation of the anti-gravity flight suits originally developed for pilots and astronauts. They were modified to combat internal bleeding in trauma victims in emergency situations. The flame retardant seats are an outgrowth of research on the flammability of polymeric materials that followed the tragic on-the-pad fire that killed three Apollo astronauts in January 1967. The radiation barrier was developed for protecting the Apollo crew capsule from the extreme temperature ranges of space, and has become a successful commercial insulation material.

"We are thrilled that these NASA-developed and inspired technologies have found such wide adaptation and helped to save the lives of so many of our citizens," said Ames' center director Dr. Henry "Harry" McDonald. "We refer to these dual uses of our technologies as spinoffs," he said. "But, in fact, they are not merely secondary applications. They provide direct, quantifiable and invaluable benefits to the American taxpayer and the domestic economy."

One of the hazards that astronauts encounter during space travel is associated with the internal shifting of body fluids during transition between varying gravity levels, from zero to many times normal, according to Dr. Bruce Webbon, chief of Ames' Extravehicular (EVA) and Protective Systems Branch. Pilots of

-more

high-performance aircraft also are subject to such fluid shifts during maneuvers. To counteract the resulting effects, trousers or flight suits containing pneumatic bladders can be worn to prevent such fluid shifts. Ames engineers have been conducting research on the design, use and effects of such garments for nearly thirty years.

In 1969, a physician at Stanford Hospital urgently requested the assistance of Ames medical and engineering personnel in controlling the internal bleeding of a dying patient. Using an anti-gravity pilot's suit and a device that applied external pressure to the legs and abdomen, the Ames team were able to stop the bleeding and save the patient. Today it is estimated that this life saving technology has now been used over two million times and that commercial sales of the anti-shock medical garments currently top a cumulative total of over $50 million.

Research into polymeric materials following the deadly Apollo fire indicated that many materials can be protected from direct ignition by the use of a fire-resistant material which essentially "encapsulates" the more flammable material, according to Ames' Demetrius Kourtides, inventor of the flame resistent seat technology.

Subsequent tests of this Ames-developed concept of using a fire blocking layer of fabric, which is thermally stable and fire resistant around existing seat cushion material, were conducted and the procedure validated in both civilian and military aircraft. More than 600,000 seats have been retrofitted since a resulting 1984 FAA regulation was instituted, and the technology is now credited with saving an estimated 25 lives each year.

The radiation barrier is a thin polymeric film that is used on virtually all spacecraft because of its unique capability to insulate and radiate in situations where delicate instruments need protection from temperature extremes. The radiation barrier is being used commercially to insulate office buildings, manufacturing plants, new homes, and automobiles.

These three technologies will be inducted into the Space Technology Hall of Fame during a gala celebration to be held in conjunction with the U.S. Space Foundation's 12th National Space Symposium on April 11 at the Broadmoor Hotel, Colorado Springs, CO. In addition to Webbon, Vic Vykukal and Dr. Ralph Pelligra, both of Ames, will be honored for their part in the anti-shock trousers technology. Kourtides will be recognized as the inventor of the flame resistant seat technology.

With the latest selections, 25 technologies will have been inducted into the Hall since the awards began in 1988. This induction will represent the second occasion on which Webbon has been honored; he was previously cited in 1993 for his work on liquid cooled garments.

-end-

Launius, Roger

From: NPAWBB
To: shuttle-status
Subject: FW: Atlantis Ferry flight Status # 5
Date: Friday, April 12, 1996 10:46AM

04/12/96 10:43 AM

Ferry flight status # 5

The orbiter Atlantis riding atop the modified 747 Shuttle Carrier Aircraft (SCA) landed at Eglin AFB, Fla., at about 10:25 a.m. EDT today.

The SCA vehicle will be refueled and prepared for the final leg of the trip back to KSC.

Departure from Eglin is expected to be about 12 - 12:30 p.m. EDT with arrival at KSC s Shuttle Landing Facility at about 1:30 p.m. EDT.

Weather forecasters continue to indicated no serious weather concerns for the remainder of the trip today.

Standard flight plans call for the SCA pilots to fly over the central Brevard Country beach areas prior to touchdown, if weather and fuel consumption permits.

Once at KSC, the orbiter will be demated from the SCA and towed to Orbiter Processing Facility bay 1. Towing operations are expected to begin Saturday morning.

Bruce Buckingham
NASA

Internet Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
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For Release

Bruce Buckingham
Kennedy Space Center, FL
(Phone: 407/867-2468)

April 12, 1996

INTERNET ADVISORY: I96-3

INTERNET USERS CAN SUBSCRIBE TO SHUTTLE STATUS REPORTS

Internet users can now obtain Kennedy Space Center (KSC) news releases and status reports by subscription. A KSC listserve will automatically forward to subscribers all KSC Space Shuttle status reports, KSC-originated news releases and other periodic reports.

To subscribe to these status reports and news releases, send an E-mail message to:

domo@news.ksc.nasa.gov.

In the body of the message (not the subject line), type:

"subscribe shuttle-status" or "subscribe ksc-press-release"
(Do not use quotation marks.)

The system will reply with a confirmation via E-mail of each subscription.

To remove your name from the list, send an E-mail message to the same address. In the body of the message type:

"unsubscribe shuttle-status" or "unsubscribe ksc-press-release"
(Do not use quotation marks.)

Internet users who also subscribe to the NASA Headquarters news-release listserve can expect a small number of duplicate messages, when news releases are issued simultaneously by KSC and Headquarters.

- end -

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

David E. Steitz
Headquarters, Washington, DC
(Phone: 202/358-1730)

April 12, 1996

VIDEO ADVISORY: V96-37

SHUTTLE ANNIVERSARY, OCEAN RESEARCH ON NTV FRIDAY

On Friday NASA TV will air footage commemorating the 15th anniversary of the first Space Shuttle flight. Commander John Young and Pilot Robert Crippen spent over 54 hours in orbit aboard Shuttle Columbia in 1981. Also airing on Friday will be features highlighting the oceanographic research being conducted by the TOPEX/Poseidon spacecraft. The spacecraft's research is a key element in NASA's Mission to Planet Earth program.

ITEM #1: STS-1, 15TH ANNIVERSARY
Anniversary footage commemorating first Shuttle flight.

ITEM #2: TOPEX/POSEIDON SPACECRAFT ANIMATION
Series of animation highlighting TOPEX/Poseidon spacecraft.

ITEM #3: TOPEX EL NINO DATA ANIMATION
Animation based on spacecraft data showing formation of 1994-95 El Nino weather condition.

ITEM #4: TOPEX/POSEIDON EL NINO COLOR MAPS
Three color maps trace development of El Nino.

Video news files air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
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Eileen Hawley
Johnson Space Center, Houston, TX
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For Release
April 12, 1996

RELEASE: 96-70

ASTRONAUTS WALKER, HARRIS LEAVE ASTRONAUT CORPS

Astronauts David M. Walker, (Captain, USN) and Dr. Bernard A. Harris, Jr. will leave NASA on April 15 to pursue other careers.

Walker will become the Vice President, Sales & Marketing, for NDC Voice Corp. in Southern California. NDC Voice will provide integrated wireless communications and advanced voice processing applications internationally.

Harris will become the Staff Vice President of Operations for SPACEHAB, Inc., Houston, TX. SPACEHAB owns and operates habitable modules which fly in the cargo bay of the Space Shuttle and are used for microgravity research and Space Station resupply activities. He also will join the teaching staff of the University of Texas Medical Branch, Galveston Center for Aerospace Medicine and Physiology as associate professor in Internal Medicine.

"Dave and Bernard have played key roles in our space program," said David Leestma, director of Flight Crew Operations. "Their expertise, skill and dedication will be missed."

Walker is a veteran of four Shuttle flights. He was the pilot on STS-51A in 1984 and commanded three Shuttle missions, STS-30 in 1989, STS-53 in 1992, and STS-69 in 1995. Harris has flown two Space Shuttle missions and was the first African-American to walk in space. He flew on STS-55 in 1991 and and STS-63 in 1995.

For complete biographical information on Harris, Walker and other astronauts, see the NASA Internet astronaut biography home page at URL:
http://www.jsc.nasa.gov/Bios/

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
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For Release

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April 12, 1996

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RELEASE: 96-71

WEATHER-CHANGING OCEAN WAVES CHARTED FROM SPACE

New results from the ocean-observing TOPEX/Poseidon satellite are challenging a fundamental oceanographic theory about the speed of large-scale ocean waves -- a finding that could ultimately revise science textbooks and improve global weather forecasting.

The large-scale ocean waves, with wavelengths of hundreds of miles from one wave crest to the next, are called Rossby waves. These waves carry a "memory" of weather changes that have happened at distant locations over the ocean, according to Dr. Dudley Chelton, a TOPEX/Poseidon science team member at the College of Oceanic and Atmospheric Sciences at Oregon State University, Corvallis.

Using data gathered by the satellite, scientists tracked the waves as they move through the open ocean and have determined that, at mid-latitudes, the Rossby waves are moving two to three times faster than previously thought, Chelton reports in today's issue of *Science* magazine.

Rossby waves are a natural result of the Earth's rotation and a key feature of large-scale ocean circulation. In animations of altimeter data from the TOPEX/Poseidon satellite, the waves appear as alternating positive and negative sea level features traveling throughout much of the world's oceans.

"Every first-year student in physical oceanography learns about Rossby waves. However, observing them away from the Equator has been extraordinarily difficult, because they cause changes in sea level of 4-8 inches, spread over hundreds of miles, and move westward so slowly that a wave may take more than ten years to cross the Pacific at the latitude of Los Angeles, and more than 30 years at the latitude of Portland, Oregon," said Dr. Victor Zlotnicki, an oceanographer at NASA's Jet Propulsion Laboratory, Pasadena, CA.

-more-

"Thanks to TOPEX/Poseidon, for the first time we can see these waves very clearly, and this research shows that they become more intense to the west of the great mountain chains on the ocean floor, and more fundamentally, that they travel much faster than the accepted theory predicts," said Zlotnicki.

Since Rossby waves can alter currents and their corresponding sea surface temperatures, the waves influence the way the oceans release heat to the atmosphere and thus are able to affect weather patterns.

For example, in 1994, oceanographers at the Naval Research Laboratory mapped a Rossby wave that they concluded was a remnant of the 1982-83 El Nino event. They found evidence that the Kuroshio current, located off the coast of Japan, was pushed northward, raising the temperature of the northwest Pacific. Some scientists blamed this shift for contributing to the flooding across the midwestern United States in 1993.

"If our traditional notions about the wave speeds are incorrect," Chelton said, "then the waves get from one side of the mid-latitude ocean to the other twice as fast, which means that the ocean evidently adjusts more rapidly than we previously thought."

This more precise information about how fast the waves are traveling may help forecasters improve their ability to predict the effects of El Nino events on weather patterns years in advance.

TOPEX/Poseidon, a joint program of NASA and the Centre Nationale d'Etudes Spatiales, the French space agency, uses a radar altimeter to precisely measure sea-surface height. Scientists use the TOPEX/Poseidon data to produce global maps of ocean topography, which then can be used to identify Rossby waves.

TOPEX/Poseidon is part of NASA's Mission to Planet Earth, a coordinated, long-term research program to study the Earth as a global system. TOPEX/Poseidon's sea-surface height data are essential to a better understanding of the role oceans play in regulating global climate, one of the least understood areas of climate research.

The Jet Propulsion Laboratory manages the U.S. portion of the TOPEX/Poseidon mission for NASA.

NOTE TO EDITORS: An image to accompany this release is available to news media representatives by calling the Imaging Branch on 202/358-1900. Photo numbers are:

B&W: 96-H-217
Color: 96-HC-217

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Douglas Isbell
Headquarters, Washington, DC
(202/358-1753)

April 12, 1996

Steve Roy
Marshall Space Flight Center, Huntsville, AL
(205/544-0034)

RELEASE: 96-72

TANTALIZING DISCOVERIES MARK FAST-TRACK LIGHTNING DETECTOR'S FIRST YEAR OF OPERATION

During its first year in orbit, a NASA lightning monitoring instrument called the Optical Transient Detector has uncovered tantalizing links between space-based lightning measurements and the intensity of severe storms.

Launched into Earth orbit on April 3, 1995, by an Orbital Sciences Corp. Pegasus rocket, the orbiting detector has produced the first high-quality images of lightning on a global scale, according to principal investigator Dr. Hugh Christian of the Global Hydrology and Climate Center, Huntsville, AL.

"Using the instrument we have determined that, in some cases, there are up to 20 times more lightning flashes within clouds than observed by the ground-based network," Christian said. "This is significant because lightning flash rates offer the intriguing possibility of assisting predictions of tornado formation."

Data from the instrument shows that severe thunderstorms tend to produce lightning within clouds while the storms are building, and then more of a mixture of cloud and ground lightning as the storms dissipate. The quantity of cloud-to-ground lightning strikes, which can be detected by the present ground-based network, increase only after the storm has matured. "This case study indicates that space-based observations may provide a more advanced warning of severe weather," said Christian.

The instrument also has observed that more lightning is produced during the northern hemisphere summer than during the southern hemisphere summer.

-more-

The experiment was made possible by a streamlined design and development approach for a new technology system.

"This highly compact lightning detector represents a sophisticated new research tool in space," said project manager Roger Chassay of the Science and Applications Projects Office at the Marshall Space Flight Center, Huntsville, AL. "The Marshall team placed the lightning detector development on a fast track when given the opportunity to fly the instrument on the Orbital Sciences Corp. satellite, Microlab-1."

The detector was built, tested, and delivered in less than a year. "Our experience clearly shows that, for payloads involving small-to-medium size and complexity, we can definitely streamline the development process and provide flight hardware of high quality that produces valuable new science."

The Optical Transient Detector is a highly compact combination of optical and electronic elements. The optics and the electronics are a little bigger than a two-pound coffee can and a typewriter, respectively. In spite of its small size, the detector represents a major advance over previous technology, given its ability to detect lightning under bright, daytime conditions as well as at night.

The Optical Transient Detector is a pathfinder for a follow-on lightning detector called the Lightning Imaging Sensor, scheduled for launch in 1997 by a Japanese rocket on the Tropical Rainfall Measuring Mission spacecraft.

"Looking to the future, this instrument is showing us that lightning observations from geostationary orbit could be very valuable for severe weather prediction and warnings," said Christian.

Data from the lightning detector is analyzed by scientists at the Global Hydrology and Climate Center. The center is operated under cooperative agreement between NASA, the University of Alabama in Huntsville and the Universities Space Research Association.

Images and motion sequences of Optical Transient Detector cloud and lightning observations are available via the World Wide Web at the following URL:

http://wwwghcc.msfc.nasa.gov:5678/otd.html

-end-

News Release

National Aeronautics and
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Washington, DC 20546
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For Release
April 12, 1996

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RELEASE: 96-73

SHUTTLE CONTRACTS TAKE FIRST STEP TOWARD CONSOLIDATION

NASA and its major Space Shuttle contractors Friday took an important step toward consolidating Shuttle operations and processing work under a single prime contractor.

Two Novation Agreements signed Friday that become effective this weekend designate United Space Alliance as the prime contractor for both Shuttle processing work currently performed by Lockheed Space Operations Company at the Kennedy Space Center (KSC), FL, and Shuttle operations work currently performed by Rockwell Space Operations Company at the Johnson Space Center (JSC), Houston, TX. United Space Alliance (USA) is a joint venture announced last year by Rockwell International Corp. and Lockheed Martin Corp. in preparation to compete for NASA's request for a single Space Flight Operations Contract.

In November 1995, NASA announced its decision to pursue a single Space Shuttle operations contract on a non-competitive basis with USA. The novation activities are designed to ease the transition to a single contract. Together, Rockwell and Lockheed Martin already hold almost 70 percent of the dollar value of all Space Shuttle-related contracts.

"This agreement basically constitutes a name change for contracts that will essentially remain intact for the near term," said Space Shuttle Program Manager Tommy Holloway. "However, it is significant in that it is the first phase of a transition to a single contract and it constitutes the first official contract between USA and NASA. This allows us to get an early start on implementing a single Space Flight Operations Contract approach, and it supports our requirement that the transition to that contract is efficient and, above all, safe."

- more -

The eventual consolidation of NASA's Space Flight Operations under a single contract is expected to reduce Shuttle costs by streamlining contractor operations and eliminating duplicative work while maintaining flight safety as the ultimate priority. NASA's involvement in the day-to-day operations of the Space Shuttle Program also is expected to decrease as greater accountability is shifted to the contractor.

The two Novation Agreements signed Friday, one covering the Space Operations Contract, NAS9-18000, with Rockwell Space Operations Co. (RSOC), and another covering the Shuttle Processing Contract, NAS10-10900, with Lockheed Space Operations Co. (LSOC), will eventually consolidate all work from the two largest Shuttle operations contracts with USA. However, in the near future, no terms or conditions of the two contracts will change and USA will immediately subcontract the same work to RSOC and LSOC that they had previously performed under their respective contracts with NASA.

-end-

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
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For Release

April 15, 1996

VIDEO ADVISORY: V96-38

HELIX NEBULA, SPACE WHEAT & TOPEX/POSEIDON ON NTV MONDAY

On Monday NASA TV will air an image of the Helix Nebula taken by NASA's Hubble Space Telescope. The vivid image reveals a collision of two gases near a dying star. Also airing on Monday is footage featuring the first wheat crop specifically developed for space at Utah State University and Rossby wave animation highlighting the oceanographic research being conducted by the TOPEX/Poseidon spacecraft.

ITEM #1: HELIX NEBULA
Colorful image taken August 1994.

ITEM #2: HELIX NEBULA DETAIL
Gaseous knots appear small but are twice the width of the solar system.

ITEM #3: WIDE VIEW OF HELIX NEBULA DETAIL

ITEM #4: ANIMATION OF THE FORMATION
Animation showing a red star collapsing into a white dwarf star.

ITEM #5: INTERVIEW - DR. C.R. O'DELL
Explanation of the Helix Nebula.

ITEM #6: SPACE WHEAT
First wheat crop developed to be used in space.

ITEM #7: INTERVIEW ON SPACE WHEAT

ITEM #8: REPLAY - TOPEX/POSEIDON SPACECRAFT ANIMATION

ITEM #9: REPLAY - TOPEX/POSEIDON ROSSBY WAVE ANIMATION

ITEM #10: REPLAY - TOPEX EL NINO DATA ANIMATION

ITEM #11: REPLAY - TOPEX/POSEIDON EL NINO COLOR MAPS

ITEM # 12: REPLAY - INTEVIEW - DR. VICTOR ZLOTNICKI

Video news files air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
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For Release

April 15, 1996

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RELEASE: 96-74

HUBBLE FINDS THOUSANDS OF GASEOUS FRAGMENTS AROUND STAR

Resembling a bizarre setting from a science fiction movie, dramatic images sent back by NASA's Hubble Space Telescope have surprised astronomers by uncovering thousands of gigantic tadpole-shaped objects surrounding a dying star.

Dubbed "cometary knots" because their glowing heads and gossamer tails superficially resemble comets, they are probably the result of a dying star's final outbursts. Although ground-based telescopic observations have hinted at such objects, they have not previously been seen in such abundance, say researchers.

The knots were detected by Hubble astronomer C. Robert O'Dell and graduate student Kerry P. Handron of Rice University in Houston, TX, while exploring the Helix nebula, a ring of glowing gases blown off the surface of a sunlike star late in its life.

O'Dell expects the gaseous knots, which are each several billion miles across, will eventually dissipate and vanish into the cold emptiness of interstellar space. However, he speculates that if the objects contract to form permanent solid bodies, they may contribute to a fraction (less than ten percent) of the missing mass of our galaxy, simply because of their sheer abundance around a typical dying star.

-more-

The mysterious "space pods" came into view as O'Dell used Hubble's Wide Field Planetary Camera 2 to survey the Helix nebula, located 450 light-years away in the constellation Aquarius and the closest planetary nebula to Earth -- so close that its angular size is almost half that of the full Moon.

The most visible cometary knots all lie along the inner edge of the ring, at a distance of trillions of miles from the central star. Their comet-like tails, each stretching a hundred billion miles, form a radial pattern around the star like the spokes on a wagon wheel. Though previous ground-based observations show a spoke pattern in the Helix, and some structure, O'Dell emphasizes that the Hubble images reveal an underlying population of many more smaller objects.

O'Dell made the observation because he was curious if these objects were the result of the star's final outburst which would bring comets out of "cold storage" by boiling off the icy, solid comet nuclei. This is how comets behave as they swing near our Sun.

The knots have just the right appearance and are at just the right distance from the dying star to be a long-sought comet cloud -- much like the hypothesized Oort cloud encircling our solar system. However, each gaseous cometary "head" is at least twice the diameter of our solar system -- far too large for the gaseous shell, called a coma, that surrounds an active comet as we know it.

The most likely explanation is the objects have been formed during the final years of a star's life when it ejects shells of gas into space. This "planetary nebula" formation happens in stages where, toward the end of the process, a faster moving shell of gas ejected off the doomed star collides with slower moving gas released ten thousand years before.

Standard models predict that the knots should expand and dissipate within a few hundred thousand years. However, dust particles inside each gas ball might collide and stick together, snowballing to planet-sized bodies over time. The resulting objects would be like Earth-sized copies of the frigid, icy planet Pluto. These icy worlds would escape the dead star and presumably roam interstellar space forever.

If this phenomena is common among stars, then our galaxy could be littered with trillions of these objects, O'Dell concludes. "Planetary nebulae have been formed in our galaxy for billions of years and about one new one is created every year since this is the usual ending for the billions of sunlike stars inhabiting our Milky Way galaxy."

Hubble will be used to search more distant planetary nebulae for similar features. O'Dell hopes to revisit the Helix in a few years and take more images which might reveal the outward motion of the knots.

The Space Telescope Science Institute is operated by the Association of Universities for Research in Astronomy, Inc. (AURA) for NASA, under contract with the Goddard Space Flight Center, Greenbelt, MD. The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency (ESA).

- end -

EDITOR'S NOTE: Two images to accompany this release are available to media representatives by calling the Imaging Branch on 202/358-1900. Photo numbers are:

	Color	B&W
Helix Nebula:	96-HC-215	96-H-215
Helix detail	96-HC-216	96-H-216

Image files in GIF and JPEG format and captions may be accessed on Internet via anonymous ftp from ftp.stsci.edu in /pubinfo

		GIF	JPEG
PRC96-13a	Helix Nebula	gif/HelixF.gif	jpeg/HelixF.jpg
PRC96-13b	Helix Detail	gif/HelixD.gif	jpeg/HelixD.jpg

Higher resolution digital versions (300dpi JPEG) of the release photographs will be available temporarily in /pubinfo/hrtemp: 96-13a.jpg, 96-13b.jpg (color), 96-13aBW.jpg and 96-13bBW.jpg (black/white).

GIF and JPEG images, captions and press release text are available via World Wide Web at:
http://www.stsci.edu/pubinfo/PR/96/13.html and via links in:
http://www.stsci.edu/pubinfo/Latest.html or
http://www.stsci.edu/pubinfo/Pictures.html.

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. NASA releases also are available via CompuServe using the command GO NASA.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
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For Release

April 15, 1996

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RELEASE: 96-75

UTAH STATE UNIVERSITY DEVELOPS SPACE CROP

The first crop developed specifically for growth in space has been developed at Utah State University, Logan, Utah.

A space-age wheat variety, USU-Apogee, produces the equivalent of almost 600 bushels of grain per acre -- three times the top yields from most fields.

It took more than a decade to develop a wheat suitable for space farms, where the artificial sun always shines, carbon dioxide levels are high and space is at a premium. Apogee thrives under those conditions. Its heads emerge 23 days after germination, about a week sooner than some varieties grown in controlled environments.

So far, Apogee's baking characteristics pass muster, at least on Earth. Making bread in space is still uncharted territory.

The wheat variety's development was funded by NASA's Office of Life and Microgravity Sciences and Applications and the Utah Agricultural Experiment Station.

On long-duration space missions, it will be more economical to provide life support supplies by producing food, such as Apogee, potable water and breathable air by recycling metabolic and other wastes.

It's not known whether the new variety will make it to the moon or Mars, but it's likely to be grown on the International Space Station scheduled for completion in 2002.

"We're tickled to death with Apogee," said space scientist Doug Ming, of NASA's Johnson Space Center in Houston. "We're seeing much higher yields than the other varieties we've tried. It's also much shorter."

-more-

Bruce Bugbee, the USU crop physiologist who developed the variety, has worked with NASA for almost 15 years. He heads a NASA-supported university research facility to develop food crops for space in a complex consisting of 30 computer-controlled growth chambers of various sizes, in addition to several greenhouses.

Previously, the only wheat to be grown in space was Superdwarf, a short (about 10 inches tall) line that Bugbee originally found in Mexico. Superdwarf's short height is an attribute, but it grew poorly and produced low yields in the prototype space farms, known as regenerative life support systems.

Apogee, which is the term for the point in orbit farthest from Earth, is a dwarf hard red spring wheat, developed from thousands of segregating lines. It produces few tillers, or branches, which tend to sap energy that a plant devotes to grain production.

It fits the bill for space farming-- short (about 18 inches tall when mature), producing an unusually large number of seeds, and luxuriant greenleaves. Other wheat grown in controlled environments tended to develop yellow leaf tips characteristic of calcium deficiency, often killing 30 percent of the leaf.

"Superdwarf required perfect conditions for growth. Apogee doesn't," Ming said.

To boost growth and yields, plants destined for space are always bathed in light, at a constant temperature and in air enriched with carbon dioxide, Bugbee said. Their roots never touch soil. All are grown hydroponically or in a crumbly substrate.

Apogee isn't likely to be as popular on Earth as other crop varieties. Its yields are comparable to taller field varieties, but its shortness hampers harvest and limits its ability to compete with weeds.

Bugbee provides free samples of Apogee to research laboratories around the world -- and to schools. To receive seed of Apogee, contact Bugbee at the USU Crop Physiology Laboratory, Utah State University, Logan, UT 84322-4820, (801) 797-2765, or e-mail (bugbee@cc.usu.edu).

-end-

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

April 17, 1996

Deanna Corridon
Headquarters, Washington, DC
(Phone: 202/358-1733)

VIDEO ADVISORY: V96-39

OSPREYS GET A NEW HOME, BOOSTER REEF ON NTV WEDNESDAY

On Wednesday NASA TV will air two environmental pieces. The first will feature footage of an Osprey nest containing two hatchlings that were relocated from the nest's original location atop an antenna calibration tower at the Kennedy Space Center. The nest was relocated to a platform about 300 feet away from the previous site. Also airing on Wednesday is replay of footage seen on NTV Tuesday of NASA's Solid Rocket Booster (SRB) training device which has now become an artificial reef.

ITEM #1: NEW RESTING PLACE
Two Osprey hatchlings find a new home.

ITEM #2: BOOSTER REEF
Solid Rocket Booster becomes an artificial reef.

Video news files air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Mark Hess
Headquarters, Washington, DC
(Phone: 202/358-1776)

April 17, 1996

RELEASE: 96-76

ADDITIONAL PERSONNEL REDUCTIONS PLANNED FOR AGENCY HEADQUARTERS

Employees of the National Aeronautics and Space Administration were notified today that NASA management will develop a plan to accelerate the downsizing of the Agency's headquarters and reduce the number of headquarters workers from its current level of 1,430 positions to 650-700 by October 1997.

The new plan anticipates a Reduction in Force at NASA headquarters to be completed by October 1, 1997.

NASA's existing downsizing plan calls for a reduction in its headquarters staff from an October 1993 level of 2,200 positions to 1,073 positions by October 2000. The new plan increases the target reduction by approximately 400 employees and accelerates the timetable for completing the reduction.

Although the target date for the reduced staffing level is still 18 months away, NASA managers decided to make the announcement today so that planning can begin immediately and employees have the information they need to make career decisions.

Agency officials had previously identified 239 positions moving from the headquarters to NASA's field centers, of which 110 have already taken place or are in process. Officials do not expect the number of jobs being transferred to NASA centers to be increased above the 239 level.

Employees will be briefed next week on the Agency's plans and procedures for conducting the Reduction in Force.

The announcement today affects only the Agency's headquarters. Agency officials will put the new headquarters structure in place to provide the foundation for the NASA centers to review their staffing needs, meet budget and program priorities, and set new staffing goals.

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. NASA releases also are available via CompuServe using the command GO NASA.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

April 18, 1996

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Headquarters, Washington, DC
(Phone: 202/358-1778)

Rob Navias
Johnson Space Center, Houston, TX
(Phone: 713/483-5111)

NOTE TO EDITORS: N96-26

STS-77 PREFLIGHT MEDIA BRIEFINGS SET FOR APRIL 30

A series of press briefings detailing the objectives planned for NASA's 77th Space Shuttle mission is scheduled for April 30 at the Johnson Space Center, Houston, TX, and the Goddard Space Flight Center, Greenbelt, MD.

Endeavour will carry a crew of six on mission STS-77, currently targeted for launch in mid-May. The crew includes Commander John Casper, Pilot Curt Brown and Mission Specialists Andy Thomas, Dan Bursch, Mario Runco and Marc Garneau.

During the planned ten-day mission, the astronauts will perform a total of four rendezvous operations with two research satellites -- the most ever during a single Space Shuttle flight. The crew will deploy the SPARTAN-207 spacecraft with the Inflatable Antenna Experiment and will conduct stationkeeping operations with a satellite called the PAMS/STU, which will investigate a new laser-based attitude system.

The SPACEHAB module containing a variety of experiments will be carried aboard Endeavour in addition to a dozen Get Away Special canisters mounted in the cargo bay that are sponsored by investigators from the U.S., Canada and Europe.

NASA TV can been seen on Spacenet 2, Transponder 5 at a frequency of 3880 Mhz and an orbital position of 69 degrees West longitude. Polarization is horizontal.

- more -

Following is a schedule for the STS-77 briefings:

STS-77 Pre-Flight Briefings
April 30, 1996
(All times listed are EDT)

9 a.m. Mission Overview (from Johnson)
Wayne Hale, STS-77 Lead Flight Director

10 a.m. SPACEHAB Overview (from Johnson)
Ed Gabris, Director, Space Processing Division, NASA Headquarters
Mike Lounge, Staff Vice President, SPACEHAB, Inc.

11 a.m. Spartan-207/Inflatable Antenna Experiment (from Goddard)
Mark Steiner, Spartan 207 Mission Manager
Dr. Steven Bard, IAE Project Manager/Jet Propulsion Laboratory
Gordon Veal, Prinicipal Investigator/LiGarde

Noon NASA TV Video File (from NASA Headquarters)

12:30 p.m. TEAMS/PAMS-STU Briefing (from Goddard)
Neal Barthelme, TEAMS Mission Manager
Alex Dula, GANE Prinicipal Investigator
Linda Pacini, PAMS Principal Investigator
Al Seigeneur, VTRE Project Manager
Dave Glaister, LMTE Project Manager

1:30 p.m. Get Away Special Briefing (from Goddard)
Charlie Knapp, Goddard
Lee Shiflett, Goddard
Tumkur Raghuram, Utah State University
Dr. Fran Chiarmonte, Lewis Research Center

2:30 p.m. BETSCE Briefing (from Goddard)
Dr. Steven Bard, BETSCE Project Manager/Jet Propulsion Laboratory

4 p.m. Crew Press Conference (from Johnson)
John Casper, Commander
Curt Brown, Pilot
Andy Thomas, Mission Specialist 1
Dan Bursch, Mission Specialist 2
Mario Runco, Mission Specialist 3
Marc Garneau, Mission Specialist 4

-end-

News Release

National Aeronautics and
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Washington, DC 20546
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For Release

April 18, 1996

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Headquarters, Washington, DC
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Allen Kenitzer
Goddard Space Flight Center, Greenbelt, MD
(Phone: 301/286-8955)

John Fritz
University of Maryland, Baltimore County
(Phone: 410/455-6596)

Ray Byrnes
U.S. Geological Survey, Reston, VA
(Phone: 703/648-4787)

NOTE TO EDITORS: N96-27

PRESS BRIEFING TO REVEAL NEW VIEW OF URBAN GROWTH

A new, animated view of the dramatic growth in urban sprawl over the Baltimore-Washington metropolitan region during the past 200 years will be the subject of a news conference at 5 p.m. on Monday, April 22, in Room 307 of the Baltimore Convention Center.

Based for the first time on actual scientific data, the computer animation visually demonstrates how environmental, economic and demographic forces can combine to generate a rapid change in the urban landscape.

The news conference is part of the national convention of the American Society for Photogrammetry and Remote Sensing (ASPRS) and the American Congress on Surveying and Mapping (ACSM). Participants are expected to include U.S. Senator Barbara Mikulski of Maryland, University of Maryland Baltimore County (UMBC) President Dr. Freeman A. Hrabowski, III, NASA Goddard Space Flight Center Director Joseph H. Rothenberg and incoming ACSM President James R. Plasker.

The animation and its supporting database were produced by the Baltimore-Washington Regional Collaboratory, a cooperative effort between UMBC, the U.S. Geological Survey and NASA's Mission to Planet Earth enterprise.

-more-

Developed using a combination of historical maps, census records, satellite-based imagery and geographic information systems, the animation tool and its supporting information will be made available to local and regional urban planners via the Internet, to aid land and resource management policy development. The same process can be applied to generate similar products for other urban areas.

Imagery from the Baltimore-Washington study and further background information will be available April 22 on the World Wide Web at the following URL:

http://www.umbc.edu/bwrdc

Standard video technical support will be provided at the briefing. Broadcast quality copies of the animation will be available. The animation also will be broadcast as part of the daily NASA TV Video File. Media planning to cover the event are requested to notify one of the listed points of contact by Noon on April 22.

-end-

News Release

National Aeronautics and
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Washington, DC 20546
(202) 358-1600

For Release

April 18, 1996

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RELEASE: 96-77

SPACE RADAR REVEALS ANCIENT SEGMENTS OF CHINA'S GREAT WALL

Scientists in China are using space radar images to locate and study two generations of the Great Wall of China that have been eroded and buried in places by centuries of blowing sand.

"In the images, we can recognize two different dynasties that built the Great Wall. One was built in the Ming Dynasty and is about 600 years old. The other was built during the Sui Dynasty and is more than 1,000 years old," said Dr. Guo Huadong, a SIR-C/X-SAR science team member from the Institute of Remote Sensing Applications at the Chinese Academy of Sciences in Beijing.

The radar images were taken by the Spaceborne Imaging Radar C/X-band Synthetic Aperture Radar (SIR-C/X-SAR) that flew on the Space Shuttle Endeavour in April and October of 1994.

The Great Wall is one of several archeological sites around the world being studied through the use of the space radar images. Other sites include Angkor, Cambodia, the Lost City of Ubar in Oman and the Silk Road along the desert of northwestern China.

"Archeology wasn't one of our original science objectives, but the imaging radar data has been found to be very useful for this type of research. It's an exciting spin-off," said Dr. Diane Evans, the SIR-C project scientist at NASA's Jet Propulsion Laboratory (JPL), Pasadena, CA. Evans is discussing the radar's role in archeological research this week at a symposium at the University of Florida, Gainesville. The week-long conference has been organized by the World Monuments Fund, the Royal Angkor Foundation and the university, with support from the J.M. Kaplan Fund and the Samuel H. Kress Foundation.

-more-

The Great Wall of China dates back to the 3rd century B.C., when it was built to protect the country from northern invaders. The wall, which spans more than 1,860 miles, has been periodically rebuilt and modified throughout history by each reigning dynasty.

The scientists are studying a segment of the wall about 430 miles west of Beijing in a remote region of the north-central China desert. The most recent version of the wall was built by the Ming Dynasty during the 14th century and it is clearly visible both on the ground and in the radar data. An older version, built during the Sui Dynasty, runs parallel to the present wall.

"Part of the wall is visible on the surface, but part of it is buried by the strong winds that blow sand dunes across this part of the desert," Guo said. "In this region the wall was made out of loose soil and mud, not bricks or rocks. Usually you cannot find these segments even if you go there, so the radar data are helping to show us the whole wall."

"Using radar to look at archeological structures has been very powerful because the radar is sensitive to vertical structures, such as walls. Even if they are highly eroded, like these segments of the Great Wall, the radar is able to capture a reflection off it and the wall shows up quite clearly in the radar image," said Dr. Jeffrey J. Plaut, the SIR-C experiment scientist at JPL. "This is a part of the world where we can also take advantage of the radar's ability to penetrate through layers of dry sand to image buried structures. The multiple channels of the SIR-C/X-SAR system increases our ability to detect different kinds of structures that a single-channel radar system would not see."

The Spaceborne Imaging Radar project is managed by JPL for NASA's Office of Mission to Planet Earth, Washington, DC. SIR-C/X-SAR is a joint mission of the United States, German and Italian space agencies.

Radar images of the Great Wall at various resolutions are available over the Internet on the JPL SIR-C/X-SAR home page at the following URL:

http://www.jpl.nasa.gov/sircxsar/

-end-

Video Advisory

National Aeronautics and
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Washington, DC 20546
(202) 358-1600

Deanna Corridon
Headquarters, Washington, DC
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For Release

April 22, 1996

VIDEO ADVISORY: V96-42

200 YEARS OF URBAN GROWTH IN THE BALTIMORE-WASHINGTON AREA ON NTV MONDAY

On Monday NASA TV will feature animation, based on scientific data, for the first time showing urban growth in the Baltimore-Washington area spanning 200 years (1792-1992). Also, NTV will air the winner of NASA's 3rd Annual Great Moon Buggy Race and B-roll from last year's race.

ITEM #1: BALTIMORE-WASHINGTON REGIONAL GROWTH
Animation showing urban growth in the Baltimore-Washington area spanning 200 years.

ITEM #2: BALTIMORE-WASHINGTON CORRIDOR GROWTH
Animation showing urban growth in the Baltimore-Washington corridor spanning 200 years.

ITEM #3: BALTIMORE (ONLY) GROWTH
Animation showing urban growth in Baltimore.

ITEM #4: WASHINGTON (ONLY) RELIEF MAP
Animation of a relief map showing urban growth in Washington.

ITEM #5: BALTIMORE (ONLY) RELIEF MAP
Animation of a relief map showing urban growth in Baltimore.

ITEM #6: "AND THE WINNER IS..."
1996 winner of NASA's 3rd Annual Moon Buggy Race.

ITEM #7: REPLAY - "AND THEY'RE OFF"

Video news files air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

Dwayne C. Brown
Headquarters, Washington, DC
(Phone: 202/358-1600)

For Release

April 24, 1996

MEDIA ADVISORY

HAMILTON STANDARD SPACE SYSTEMS INTERNATIONAL RECEIVES LOW AWARD

Hamilton Standard Space Systems International, Inc., Windsor Locks, CT, was the recipient of the 1995 George M. Low Award -- NASA's highest award for quality and excellence -- at the Eleventh Annual NASA Continual Improvement and Reinvention Conference held in Alexandria, VA, on April 17, 1996.

In announcing the selection, NASA Administrator Daniel S. Goldin recognized the company "for having a fully institutionalized quality management philosophy and techniques that demonstratively result in superior product development and delivery."

Hamilton Standard Space Systems International, Inc. is the prime contractor to NASA for its space suit, the Extravehicular Mobility Unit. The company also provides seven major life support and thermal control systems on the Space Shuttle Orbiter that function during its launch, orbit, and reentry phases. Additionally, the company is designing and manufacturing life support and thermal control subsystems for the U.S. Modules, the Japanese Experiment Module, the Columbus Orbital Facility, and the Mini-Pressurized Logistics Module on the International Space Station.

"Over the past several years, this organization has significantly, and laudably demonstrated outstanding success in reengineering their operations and processes, improving cost and schedule, and focusing on customer satisfaction," said Fred Gregory, Associate Administrator for the Office of Safety and Mission Assurance, and chair of the George M. Low Award Panel of Judges.

The Low Award is presented to current suppliers who demonstrate sustained excellence and outstanding achievements in executing the Total Quality Management philosophy. The award is linked with the Malcolm Baldridge National Quality Award to support the national effort to achieve quality excellence throughout industry.

-end-

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
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For Release

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April 24, 1996

VIDEO ADVISORY: V96-43

NEAR EARTH ASTEROID TRACKING SYSTEM, SIXTH ANNIVERSARY OF THE HUBBLE SPACE TELESCOPE ON NTV WEDNESDAY

On Wednesday NASA TV will feature the Near Earth Asteroid Tracking System (NEAT) which has been developed by scientists in order to track the positions of asteroids and comets in respect to the Earth. The system is comprised of a camera that has been installed on a telescope and set up to examine the sky from Maui's Haleakala volcano. Also, airing on NTV will be a compilation of ten images taken by NASA's Hubble Space Telescope commemorating it's sixth anniversary.

ITEM #1: NEAR EARTH ASTEROID TRACKING SYSTEM
Sensors bring new asteroids and comets into focus.

ITEM #2: INTERVIEW - DR. ELEANOR HELIN
Principal investigator of the NEAT camera team at JPL.

ITEM #3: INTERVIEW - DR. STEVEN PRAVDO
Manager of the NEAT Project at JPL.

ITEM #4: HUBBLE TOP TEN
Ten of the best images taken by the Hubble Space Telescope.

Video news files air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
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Washington, DC 20546
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April 24, 1996

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RELEASE: 96-78

LATEST SENSORS BRING NEW ASTEROIDS AND A COMET INTO FOCUS

Operating a newly installed electronic camera pointed at the night sky from atop Maui's Haleakala volcano, NASA astronomers have discovered four new Earth-crossing asteroids and a fast-moving comet, just months after initiating a new near-Earth asteroid and comet discovery program.

The camera -- called NEAT, for Near-Earth Asteroid Tracking system -- enabled astronomers at NASA's Jet Propulsion Laboratory (JPL), Pasadena, CA, to make their first discovery of a new long-period comet on March 15, the first night of the monthly observing program. The comet was officially designated 1996 E1, after confirmation was received from observers in Maui, Australia, Japan, the Czech Republic and Camarillo, CA.

"This relatively bright, magnitude 16 comet was discovered in the constellation of Cancer," said Dr. Eleanor Helin, principal investigator of the NEAT camera team at JPL. "It was diffuse, with strong central condensation, sporting a 15-arcsecond tail. Its closest approach to Earth, at about 30 million miles, occurred at the end of March."

The comet, which has a parabolic orbit highly inclined to the ecliptic plane, is on a long journey through the Solar System. Named NEAT 1, the long-period comet was discovered automatically by NEAT's software and was sighted, coincidentally, on the Ides of March, "a most auspicious beginning for a discovery program," Helin added.

Four unusual Earth-crossing asteroids also were discovered using NEAT, which is the world's first autonomous imaging system. These near-Earth asteroids have been designated 1996 EN, 1996 EO, 1996 FR3 and 1996 FQ3.

-more-

"All are noteworthy for different reasons," Helin said. "1996 EN is a large, 1.8 mile-diameter asteroid which moves in a very elliptical orbit and displays a high inclination of 39 degrees relative to the ecliptic plane. As a result of its brightness at magnitude 15.5, and its placement with respect to Earth, it will be accessible for observations through the end of the year."

Of the other Earth-crossers, 1996 EO has a diameter of a little more than 1/2 mile. It is not on a collision course with Earth, but asteroids of this size and larger have been identified by the scientific community as sufficient to cause severe damage over a large area of Earth should one impact the planet, Helin noted.

Significant because it moves in a long elliptical orbit extending well inside the orbit of Venus, 1996 FR3 is one of only a handful of asteroids that passes so close to the Sun. Astronomers speculate that this object may be an extinct comet, having passed close to the Sun enough times to have lost its gaseous atmosphere.

About 328 feet in diameter, 1996 FQ3 is a small near-Earth asteroid with an absolute magnitude of 21. Although small, Helin believes this asteroid may prove to be a possible candidate for a future spacecraft fly-by mission, given its very low inclination of one degree relative to the ecliptic plane.

The discovery of the four new Earth-crossing asteroids represents half of all the Earth-crossing asteroids discovered worldwide during the month of March. Two of the discoveries -- 1996 EN and 1996 FR3 -- are classified as "potentially hazardous asteroids," capable of coming exceedingly close to the Earth.

"These discoveries certainly suggest that we could face a surprise encounter with a large, unseen object," Helin said. "If these newly discovered Earth-crossing asteroids have not been seen before, then there is strong evidence that many others are near the vicinity of Earth and the inner planets, which NEAT and other programs are designed to discover."

March was the first "good weather" month for NEAT astronomers since the new electronic camera came on-line in December 1995,. said Dr. Steven Pravdo, manager of the project at JPL. The March observing run alone produced more than 1,000 asteroid sightings, including high-inclination inner-belt asteroids and a number of potential Mars-crossers. Total detections since NEAT went on-line in December 1995 have climbed to more than 2,400 objects, of which about 45 percent are known objects and more than 200 to date are new discoveries receiving new asteroid designations.

When the camera is upgraded later this month to use a very large 4,096 by 4,096-pixel charge-coupled device (CCD), astronomers expect to detect four times the number of comets and asteroids currently being observed.

Developed at the JPL, the NEAT system and its operation mark the beginning of a new era in observing programs focused on discovering and tracking asteroids and comets -- fleeting chunks of rock and ice -- as they enter the inner solar system from deep space. The autonomous imaging system contains a sophisticated computer controller and a highly sensitive CCD camera sensor.

"NEAT is next-generation technology that will significantly improve our capabilities to detect near-Earth objects," Pravdo said.

The NEAT camera is installed on a 39-inch telescope operated at the summit of Mt. Haleakala by the U.S. Air Force. With its short exposure time and fast electronics, NEAT is able to achieve wide-sky coverage and detect objects much fainter than was possible using the photographic Schmidt telescope at Palomar Observatory in Southern California.

Systematic searches for asteroids and comets destined to cross Earth's orbit have been the topic of renewed interest in recent years, especially in the aftermath of Comet Shoemaker Levy-9 and the recent arrival of Comet Hyakutake. Today charge-coupled devices -- light detectors made of silicon -- are emerging as a favored approach to asteroid detection because CCD sensors can record light 100 times more efficiently than the most sensitive photographic film.

NEAT will be managed jointly by JPL and the U.S. Air Force. JPL manages its portion of the program for NASA's Office of Space Science, Washington, DC.

-end-

Video Advisory

National Aeronautics and
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Washington, DC 20546
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Headquarters, Washington, DC
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For Release

April 25, 1996

VIDEO ADVISORY: V96-44

SHANNON LUCID INTERVIEW, MIR/PRIRODA DOCKING, SHUTTLE INSULATION COOLS NASCAR DRIVER ON NTV THURSDAY

On Thursday NASA TV will feature an ABC interview with U.S. Astronaut Shannon Lucid, who is currently aboard the Mir Space Station. Also, being featured on NTV, are still images of the Priroda spacecraft docking with the Mir Space Station and footage of how insulation developed for the Space Shuttle was used to reduce temperatures in NASCAR driver Rusty Wallace's Ford Thunderbird during a recent test at the Daytona International Speedway. Replaying on NTV will be the Near Earth Asteroid Tracking System (NEAT), and interviews regarding the project with Dr. Eleanor Helin and Dr. Steve Pravdo.

ITEM #1: ABC/SHANNON LUCID INTERVIEW
Interview with Astronaut Shannon Lucid and ABC.

ITEM #2: MIR/PRIRODA DOCKING
Still images of Mir/Priroda docking.

ITEM #3: NASCAR IS EVEN COOLER
Shuttle insulation reduces temperatures in cockpit of NASCAR driver's car.

ITEM #4: REPLAY - NEAT
Sensors bring new asteroids and comets into focus.

ITEM #5: REPLAY - INTERVIEW - DR. ELEANOR HELIN
Principal investigator of the NEAT camera team discusses the program's accomplishments.

ITEM #6: REPLAY - INTERVIEW - DR. STEVEN PRAVDO
Manager of the NEAT project discusses the benefits of the camera.

Video news files air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
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Washington, DC 20546
(202) 358-1600

For Release

April 25, 1996

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Ann Hutchison
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RELEASE: 96-79

INDEPENDENT TASK FORCE FORMED TO REVIEW BION MISSION

Ronald Merrell, M.D., Chairman, Department of Surgery, Yale University, New Haven, CT, will chair an independent task force which will review the ethical integrity of the science to be performed on the upcoming Bion 11 and 12 missions.

The task force was formed by the NASA Advisory Council at the request of NASA Administrator Daniel S. Goldin. The task force's membership and schedule were reviewed at the council's meeting today at NASA Headquarters.

The Bion program is a cooperative space venture among the U.S., Russian and French space agencies for the conduct of biomedical research using Russian-owned rhesus monkeys. Bion 11 is expected to launch from Russia in September 1996 and has a mission duration of approximately 14 days. Bion 12 is scheduled for launch from Russia in 1998. Both Russian spacecraft are uncrewed and retrievable.

Goldin asked that a prompt and thorough review be done to determine whether the Bion missions meet NASA's requirements that the highest of ethical standards be met during all phases of these missions, and that the Bion science is of the highest integrity.

Specifically, the task force will review: the integrity of the science plan for the mission; assure that there are no alternative means for obtaining the information provided by these experiments; and review the Bion Program for ethical and humane animal treatment during all phases of the mission. The task force will formally report its recommendations to the NASA Advisory Council by the end of July 1996.

-more-

Other panel members selected thus far are: Tom L. Beauchamp, Ph.D., Georgetown University, Washington, DC; Jeffrey Borer, M.D., Cornell University Medical Center, New York, NY; Bonnie Beaver, D.V.M., Texas A&M University, College Station, TX; Michael Katovich, Ph.D., University of Florida, Gainesville, FL; Marjorie Lees, Ph.D., Eunice Kennedy Shriver Center, Waltham, MA; Franklin M. Loew, D.V.M., Ph.D., Cornell University, Ithaca, NY; Chester M. Pierce, M.D., Harvard University, Cambridge, MA; James B. Snow, Jr., M.D., National Institutes of Health, Bethesda, MD; Robert Whitney, D.V.M., Steilacoom, WA and Commander Lorenzo York, U.S.N. Chaplain, Uniformed Services University of the Health Sciences, Bethesda, MD. Gary B. Ellis, Ph.D. is the liaison for the National Institutes of Health's Office for Protection from Research Risks, Rockville, MD.

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. NASA relec also are available via CompuServe using the command GO NASA.

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For Release

Deanna Corridon
Headquarters, Washington, DC
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April 26, 1996

VIDEO ADVISORY: V96-45

PRIRODA DOCKS WITH MIR, F-15 ACHIEVES FIRST SUPERSONIC YAW VECTORING FLIGHT ON NTV FRIDAY

On Friday NASA TV will transmit a replay of the April 26, 1996, Priroda/Mir docking. Priroda carried a payload of life science experiments that will be used by astronaut Shannon Lucid aboard Mir. The spacecraft will be attached to the Mir Space Station as a permanent life science lab module. NTV also will televise the first supersonic yaw vectoring flight that the F-15 Advanced Control Technology for Integrated Vehicles (ACTIVE) aircraft achieved at the Dryden Flight Research Center. Replaying on NTV will be an interview with astronaut Shannon Lucid, still images of the Priroda spacecraft docking with the Mir Space Station, Space Shuttle insulation that reduces temperatures in NASCAR driver Rusty Wallace's Ford Thunderbird, and footage of the Near Earth Asteroid Tracking System (NEAT).

ITEM #1: MIR/PRIRODA DOCKING (REPLAY)
Mir/Priroda docking on April 26, 1996.

ITEM #2: FIRST SUPERSONIC YAW VECTORING FLIGHT
F-14 ACTIVE aircraft takes flight.

ITEM #3: REPLAY - ABC/SHANNON LUCID INTERVIEW
Interview with Astronaut Shannon Lucid.

ITEM #4: REPLAY - MIR/PRIRODA DOCKING
Still images of Mir/Priroda docking.

ITEM #5: REPLAY - NASCAR IS EVEN COOLER
Shuttle insulation reduces temperatures in cockpit of NASCAR driver's car.

ITEM #6: REPLAY - NEAT

ITEM #7: REPLAY - INTERVIEW - DR. ELEANOR HELIN

ITEM #8: REPLAY - INTERVIEW - DR. STEVEN PRAVDO

Video news files air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

April 29, 1996

Don Savage
Headquarters, Washington, DC
(Phone: 202/358-1547)

Jim Sahli
Goddard Space Flight Center, Greenbelt, MD
(Phone: 301/286-0697)

NOTE TO EDITORS: N96-28

NEW FINDINGS ON THE NOT-SO-"QUIET" SUN SUBJECT OF MAY 2 UPDATE

Initial findings from the recently launched Solar and Heliospheric Observatory (SOHO), as well as dramatic new images and movies, will be presented at a Space Science Update (SSU) scheduled for 1 p.m. EDT Thursday, May 2. The SSU will originate from the NASA Headquarters Auditorium, 300 E St., SW, Washington, DC, and will be carried live on NASA TV with two-way question-and-answer capability for reporters covering the event from participating NASA centers.

Astronomers will report new information on strange "plume" structures in the atmosphere of the Sun, shown in new high-resolution ultraviolet movies from SOHO which reveal the source of long, feathery plumes that extend to high altitudes from regions near the poles of the Sun. To investigators' surprise, SOHO instruments show that there are continuous disturbances on the Sun although it is in a supposedly "quiet" period near the minimum of the 11-year sunspot cycle.

Participants in the Space Science Update will be:
Dr. Joseph Gurman, Goddard Space Flight Center (GSFC), MD.
Dr. Craig E. DeForest, Stanford University, Stanford, CA.
Dr. Andrea K. Dupree, Harvard-Smithsonian Center for Astrophysics, Boston
Dr. P.Brendan Byrne, Armagh Observatory, N. Ireland
Dr. Stephen P. Maran, GSFC, will be the panel moderator.

Audio of the broadcast will be available on voice circuit from the Kennedy Space Center at 407/867-1260.

- end -

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

Michael Braukus
Headquarters, Washington, DC
(Phone: 202/358-1600)

For Release

April 30, 1996

RELEASE: 96-80

SCIENCE HEAD TO LEAVE NASA

Harry C. Holloway, M.D., NASA's Associate Administrator for the Office of Life and Microgravity Sciences and Applications, has completed his temporary assignment at NASA and will return to the School of Medicine at the Uniformed Services University of the Health Sciences, Bethesda, MD.

"Harry brought great leadership to this office," said NASA Administrator Daniel S. Goldin. "His commitment to conducting only peer reviewed science in space has reinforced NASA's reputation as a world leader in life and microgravity sciences." Holloway will leave April 30, 1996. A replacement has not been selected.

Holloway had the distinction of being the first associate administrator for the Office of Life and Microgravity Sciences and Applications after the office was established by Goldin on March 8, 1993.

Holloway's accomplishments during his tenure included the establishment of programs which emphasized conducting experimental sciences on orbit and the development of technologies to support those programs. Holloway oversaw completion of an integrated strategic plan for the Human Exploration and Development of Space.

During Holloway's tenure, the office also developed the plan for the scientific integration of the International Space Station and the outfitting of its science facilities to support utilization. The office initiated the integrated science and utilization plan for the Shuttle-Mir program, established an international reputation for integrity in the selection and support of science for all office programs, and promoted an expanded cooperative relationship between NASA and the National Institutes of Health. Ten cooperative agreements were signed with the National Institutes of Health during Holloway's three-year tenure.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Don Savage
Headquarters, Washington, DC
(Phone: 202/358-1727)

April 30, 1996
Embargoed until 1 p.m. EDT

Jim Sahli
Goddard Space Flight Center, Greenbelt, MD
(Phone: 301/286-0697)

RELEASE: 96-81

NASA SPACECRAFT DISCOVERS FASTEST STELLAR VIBRATIONS YET

Astronomers working with NASA's Rossi X-Ray Timing Explorer (XTE) spacecraft have discovered rapid fluctuations in the intensity of X-ray emissions from three unusual binary star systems that appear to be the signatures of the fastest vibrations ever detected in celestial objects.

In one case, the oscillations reached frequencies as high as 1,130 times per second. The new findings are being reported today at a meeting of the High Energy Astrophysics Division of the American Astronomical Society in San Diego.

The observations made using Rossi XTE offer scientists a new window on the strange physical conditions that scientists envision on neutron stars, which are believed to form when massive stars reach the ends of their lives and then explode as supernovas. The outer layers of a supernova are expelled into space, while its inner core remains and becomes a neutron star. Unlike normal stars, which are balls of hot gas, neutron stars are believed to possess solid crusts.

The first detection of the remarkable fluctuations by Rossi XTE was made in February 1996. Astronomers led by Dr. Tod Strohmayer of the Universities Space Research Association (USRA) were observing the binary star 4U 1728-34, located in the general direction of the center of the Milky Way galaxy, in the constellation Sagittarius.

This star pair was already well known to astronomers as a frequent source of powerful bursts of X-rays, which are thought to originate in hot gas that has streamed downward onto a very small and dense star known as a neutron star

-more-

from a companion star. As the gas accumulates on the neutron star, it turns into a natural nuclear bomb, burning with a thermonuclear flash that produces a burst of X-rays lasting about ten seconds.

Fortunately, 4U 1728-34 was in a bursting state when the Rossi XTE observations commenced. The astronomers were able to detect both the powerful bursts and the weaker "persistent" X-ray emission that is always emanating from the binary star. "We were very excited to catch several X-ray bursts in our first pointing at the object. We were even more excited when a quick look at the persistent X-rays data revealed very high frequency, nearly periodic oscillations which no one had ever seen before," said Strohmayer, who is stationed at NASA's Goddard Space Flight Center, Greenbelt, MD. "The observations seem to confirm long-standing theoretical ideas suggesting that physical conditions on a neutron star can change in less than one millisecond." (A millisecond is one-thousandth of a second.)

The oscillations detected in 4U 1728-34 occurred at varying rates, reaching as high as 1,100 times per second. In subsequent Rossi XTE observations, investigators led by Michiel van der Klis of the University of Amsterdam, The Netherlands, have detected even faster oscillations in X-rays emitted by another binary star system, Scorpius X-1, which is named for the constellation in which it is located.

Scorpius X-1 was the first object beyond the Solar System to be detected as a source of X-rays. In Scorpius X-1, the oscillations observed with the Rossi XTE have reached rates as high as 1,130 times per second.

Further observations by the spacecraft's instruments have found oscillations of up to 900 times per second in a third binary star, 4U 1608-52, in the constellation Norma. Research on that star was led by Jan van Paradijs of the University of Alabama, Huntsville, and the University of Amsterdam, and by William Zhang of USRA, who is also from Goddard. Each of these three binary star systems contains a neutron star, and all of them are located in the southern sky.

"It's possible that the oscillating X-ray emissions come from gas orbiting very close to the neutron star," according to Strohmayer. For example, material orbiting at ten miles above a neutron star would circle it about 700 times per second. "We have also measured a very periodic oscillation of 363 times per second during the bursts from 4U 1728-34. This may be the period at which the neutron star is spinning," he added. Other Rossi XTE data support this interpretation.

"A more controversial possibility," he added, "is that we may be detecting for the first time the influence of waves on the surface of the neutron star or

within its solid crust." Such waves occur in the gaseous layers of the Sun and other stars, but have not previously been found in neutron stars. "The detection of such waves might allow us to probe the unseen interiors of neutron stars, just as seismologists use earthquake waves to explore the inner layers of the Earth."

The possibility that the Rossi XTE has detected actual waves in neutron stars or a very fast rotation period of one such star is of great scientific interest, said Jean Swank, Rossi XTE Project Scientist at Goddard and a collaborator in the research on all three binary star systems. If surface waves have been detected, that would be a scientific first. If a very fast rotation period has been detected in a neutron star in an X-ray binary system, the finding would tend to confirm a theory that certain very fast radio pulsars, known to be rotating neutron stars, are descended from fast-rotating members of X-ray binaries.

In any case, "we have succeeded in one of our prime goals for this spacecraft, to detect and characterize rapid changes in celestial X-ray sources that may reveal their underlying physical conditions," Swank said.

XTE was launched by a Delta II rocket on Dec. 30, 1995. Subsequently, NASA renamed it in honor of the late Professor Bruno Rossi of the Massachusetts Institute of Technology, Cambridge, one of the pioneers of X-ray astronomy. The Earth-orbiting spacecraft carries the largest X-ray detector yet flown in space, the Proportional Counter Array, which was developed at Goddard by Swank and her team members.

-end-

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. NASA releases also are available via CompuServe using the command GO NASA.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Don Savage
Headquarters, Washington, DC
(Phone: 202/358-1547)

Eileen Hawley
Johnson Space Center, Houston, TX
(Phone: 713/483-5111)

April 30, 1996

RELEASE: 96-82

NASA BEGINS PROCESS TO ESTABLISH A NATIONAL SPACE BIOMEDICAL RESEARCH INSTITUTE

NASA will take the first step May 1 in awarding a cooperative agreement to establish a National Space Biomedical Research Institute (NSBRI) to lead efforts in biomedical research with the release of a draft solicitation for proposals.

Using NASA's expertise in space life sciences, its unique facilities and engineering assets, the NSBRI will support a wide variety of basic and applied biomedical sciences designed to support the presence of humans in space and to use that knowledge to enhance life on Earth.

"The concept of the Biomedical Research Institute is in keeping with our plans to more closely bind NASA's scientific knowledge and our immense engineering and technical resources to the community," said Johnson Space Center Director George W.S. Abbey. "This will reinforce our links with the external community and put NASA-driven technology in the hands of the business and academic community where it can be used to help people in everyday life."

A draft Cooperative Agreement Notice to solicit proposals for establishing the NSBRI will be issued May 1. The CAN will be available from the Johnson Space Center Industry Assistance Office, Code BD35, Houston, TX 77058, at 713/483-4511; or through the Internet at URL:

http://www.jsc.nasa.gov/bd2

under "business opportunities."

-more-

NASA will provide core funding, in addition to research opportunities funded through yearly competitions, to ensure a focused and successful endeavor. The overall period of the cooperative agreement will be 20 years, a five-year initial period, with the option of three five-year extensions.

The NSBRI is part of the NASA Science Institutes concept announced by NASA Administrator Daniel S. Goldin last year.

- end -

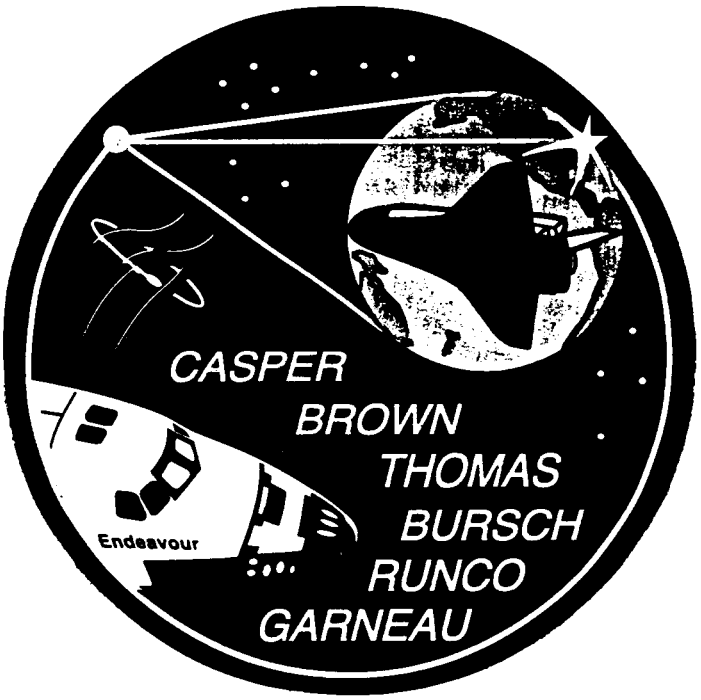
NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. NASA releases also are available via CompuServe using the command GO NASA.

94-83

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE SHUTTLE MISSION STS-77

PRESS KIT
MAY 1996



Spartan 207, SPACEHAB-4

For Information on the Space Shuttle

Ed Campion Headquarters, Washington, DC	Policy/Management	202/358-1778
Rob Navias Johnson Space Center, Houston, TX	Mission Operations Astronauts	713/483-5111
Bruce Buckingham Kennedy Space Center, FL	Launch Processing KSC Landing Information	407/867-2468
June Malone Marshall Space Flight Center, Huntsville, AL	External Tank/Shuttle Propulsion	205/544-0034
Cam Martin Dryden Flight Research Center, Edwards, CA	DFRC Landing Information	805/258-3448

For Information on STS-77 Experiments & Activities

James Cast Headquarters, Washington, DC	SPACEHAB	202/358-1779
Mike Braukus Headquarters, Washington, DC	Science/Secondary Payloads	202/358-1979
Fred Brown Goddard Space Flight Center, Greenbelt, MD	Spartan-207/TEAMS	301/286-7277
Tammy Jones Goddard Space Flight Center, Greenbelt, MD	GAS Payloads	301/286-5566

CONTENTS

RELEASE: 96-83

SPACE COMMERCIALIZATION AND TECHNOLOGY DEMONSTRATIONS HIGHLIGHT SHUTTLE MISSION STS-77

NASA's fourth Shuttle mission of 1996 is devoted to the continuing effort to help open the commercial space frontier.

During the flight, designated STS-77, Endeavour and a six-person crew will perform microgravity research aboard the commercially owned and operated SPACEHAB Module. Endevour's crew also will deploy and retrieve a research satellite and perform rendezvous operations with a test satellite.

Launch of Endeavour is currently targeted for May 16, 1996 at approximately 6:32 a.m. EDT from Kennedy Space Center's Launch Complex 39-B. The STS-77 mission is forecast to last 10 days, 0 hours, 37 minutes. The actual STS-77 flight duration will be determined by power consumption and the amount of cryogenic fuel available to support Endeavour's electrical power system depending on how close to the target launch date Endeavour actually begins its mission. Mission Control in Houston will closely monitor power consumption along with cryo reserves. Shuttle managers will have the option of shortening the mission one day if necessary. An on-time launch and full 10-day mission duration will result in a landing on May 26 at 7:09 a.m. EDT at Kennedy Space Center's Shuttle Landing Facility, FL.

The STS-77 crew is commanded by John Casper, making his fourth Shuttle flight. The pilot for the mission, Curt Brown, is making his third flight. There are four mission specialists assigned to the flight. Andrew Thomas, serving as Mission Specialist-1, is making his first flight. Mission Specialist-2 is Dan Bursch is making his third flight. Mario Runco, serving as Mission Specialist-3, also is making his third flight. Mission Specialist-4 is Canadian astronaut Marc Garneau, who is flying in space for the second time.

Over 90 percent of the payloads aboard Endeavour are being sponsored by NASA's Office of Space Access and Technology, Washington, DC, through its Commercial Space Centers and their industrial affiliates. Primary payloads include experiments flying aboard the pressurized, commercially-developed SPACEHAB Module, the Inflatable Antenna Experiment to be deployed aboard the free-flying Spartan-207 carrier spacecraft, and a suite of four technology experiments known as "TEAMS," in the Shuttle's payload bay.

Additionally, secondary experiments on the flight will include a "Brilliant Eyes" cryo-cooling experiment, a facility for examining the effect of microgravity on small aquatic creatures, and a small facility for examining the microgravity effects on simple living systems.

In 1990 NASA contracted SPACEHAB, Inc. for the lease of their SPACEHAB Space Research Laboratories for a series of flights. STS-77 marks the fourth flight of the SPACEHAB under this contract.

The SPACEHAB single module will be carrying nearly 3,000 pounds of experiments and support equipment for 12 commercial space product development payloads in the areas of biotechnology, electronic materials, polymers and agriculture as well as several experiments for other NASA payload organizations. One of these, the Commercial Float Zone Facility (CFZF) has been developed through international collaboration between the U.S., Canada and Germany. It will heat various samples of electronic and semi-conductor material through the float zone technique.

Another facility on SPACEHAB will be the Space Experiment Facility (SEF), which will grow crystals by vapor diffusion. This experiment is expected to yield large, defect-free crystals that are important for electronic applications and remote sensing.

In addition to the SPACEHAB module, the Goddard Space Flight Center's deployable Spartan 207 is another one of the primary payloads on this flight and the most ambitious Spartan mission to date. It will deploy and test the Inflatable Antenna Experiment (IAE). The IAE experiment is meant to lay the groundwork for future technology development in inflatable space structures and will be launched and inflated like a balloon on orbit. The experiment will validate the deployment (inflation) and performance of a large inflatable antenna during a ninety-minute mission. The antenna structure then will be jettisoned and the Spartan spacecraft recovered at mission end.

Inside Endeavour's cargo bay will be four experiments called Technology Experiments for Advancing Missions in Space (TEAMS): The Global Positioning System (GPS) Attitude and Navigation Experiment (GANE) will determine to what accuracy the GPS system can supply attitude information to a space vehicle; the Vented Tank Resupply Experiment (VTRE) will test improved methods for in-space refueling; the Liquid Metal Thermal Experiment (LMTE), which will evaluate the performance of liquid metal heat pipes in microgravity conditions, and the Passive Aerodynamically Stabilized Magnetically Damped Satellite (PAMS) payload will be a technology demonstration of the principle of aerodynamic stabilization in the upper atmosphere of low-Earth orbit. Cameras on the Shuttle will record the PAMS satellite as it is deployed. Later during the mission the Shuttle will rendezvous with the satellite on two separate days and will point the PAMS measuring system, while cameras aboard the Shuttle record the satellite's movements.

The Brilliant Eyes Ten Kelvin Sorption Cryocooler Experiment (BETSCE) carries an instrument that can quickly cool infrared and other sensors to near absolute zero using the evaporation of hydrogen. BETSCE is a technology demonstration experiment to show that cryocoolers of this type, called "sorption coolers," can operate in the absence of gravity. Sorption coolers have essentially no vibration, are very efficient at these cold temperatures, and can operate reliably for over 10 years.

NASA's Office of Life and Microgravity Sciences and Applications, Washington, DC, is responsible for two experiments. The two experiments are the Aquatic Research Facility (ARF), and the Biological Research In a Canister (BRIC).

The ARF is a joint Canadian Space Agency/NASA project and will be making its first flight into space on Endeavour. The ARF allows sophisticated investigations with a wide range of small aquatic species. The facility will permit scientists to investigate the process of fertilization, embryo formation and development of calcified tissue and feeding behaviors of small aquatic organisms while in microgravity.

The BRIC payload has flown several times. The focus on this flight will be on the tobacco hornworm during its metamorphosis period. This study will examine the synthesis of protein necessary to form muscle. Analysis will be made using the hemolymph (blood), flight muscle, intersegmental muscles and cuticle of the insect. This study will clarify the mechanism(s) behind one endocrine system in insects which may aid in research on endocrine systems in general, including those of humans when subject to microgravity effects.

end of general release

Media Services Information

NASA Television Transmission

NASA Television is available through the Spacenet-2 satellite system. Spacenet-2 is located on Transponder 5, at 69 degrees West longitude, frequency 3880.0 MHz, audio 6.8 MHz.

The schedule for television transmissions from the Orbiter and for mission briefings will be available during the mission at Kennedy Space Center, FL; Marshall Space Flight Center, Huntsville, AL; Dryden Flight Research Center, Edwards, CA; Johnson Space Center, Houston, TX; and NASA Headquarters, Washington, DC. The television schedule will be updated to reflect changes dictated by mission operations.

Television schedules also may be obtained by calling COMSTOR at 713/483-5817. COMSTOR is a computer data base service requiring the use of a telephone modem. A voice update of the television schedule is provided daily at noon Eastern time.

Status Reports

Status reports on countdown and mission progress, on-orbit activities and landing operations will be produced by the appropriate NASA newscenter.

Briefings

A mission press briefing schedule will be issued prior to launch. During the mission, status briefings by a flight director or mission operations representative and when appropriate, representatives from the payload team, will occur at least once each day. The updated NASA television schedule will indicate when mission briefings are planned.

Internet Information

The NASA Headquarters Public Affairs Internet Home Page provides access to the STS-77 mission press kit and status reports. The address for the Headquarters Public Affairs Home Page is:
http://www.nasa.gov/hqpao/hqpao_home.html

Informational materials, such as status reports and TV schedules, also are available from an anonymous FTP (File Transfer Protocol) server at **ftp.hq.nasa.gov/pub/pao**. Users should log on with the user name "anonymous" (no quotes), then enter their E-mail address as the password. Within the /pub/pao directory there will be a "readme.txt" file explaining the directory structure.

Pre-launch status reports from KSC are found under **ftp.hq.nasa.gov/pub/pao/statrpt/ksc**, and mission status reports can be found under **ftp.hq.nasa.gov/pub/pao/statrpt/jsc**. Daily TV schedules can be found under **ftp.hq.nasa.gov/pub/pao/statrpt/jsc/tvsked**.

Access by CompuServe

Users with CompuServe accounts can access NASA press releases by typing "GO NASA" (no quotes) and making a selection from the categories offered.

STS-77 QUICK LOOK

Launch Date/Site:	May 16, 1996/KSC Launch Pad 39-B
Launch Time:	6:32 AM EDT
Launch Window:	2 hours, 30 minutes
Orbiter:	Endeavour (OV-105), 11th flight
Orbit Altitude/Inclination:	153 nautical miles, 39 degrees
Mission Duration:	10 days, 37 minutes (if power margins permit)
Landing Date:	May 26, 1996
Landing Time:	7:09 AM EDT
Primary Landing Site:	Kennedy Space Center, FL
Abort Landing Sites:	Return to Launch Site - KSC Transoceanic Abort Sites - Ben Guerir, Morocco Moron, Spain Zaragoza, Spain Abort-Once Around - Edwards Air Force Base, CA
Crew:	John Casper, Commander (CDR) Curt Brown, Pilot (PLT) Andrew Thomas, Mission Specialist 1 (MS 1) Dan Bursch, Mission Specialist 2 (MS 2) Mario Runco, Mission Specialist 3 (MS 3) Marc Garneau, Mission Specialist 4
EVA Crew (if required):	Mario Runco (EV 1), Dan Bursch (EV 2)
Cargo Bay Payloads:	SPACEHAB-04 BETSCE Spartan-207/IAE TEAMS-01
In-Cabin Payloads:	ARF-1 BRIC-07

Shuttle Abort Modes

Space Shuttle launch abort philosophy aims toward safe and intact recovery of the flight crew, Orbiter and its payload. Abort modes for STS-77 include:

- Abort-To-Orbit (ATO) -- Partial loss of main engine thrust late enough to permit reaching a minimal 105-nautical mile orbit with the orbital maneuvering system engines.

- Abort-Once-Around (AOA) -- Earlier main engine shutdown with the capability to allow one orbit of the Earth before landing at the Kennedy Space Center, FL.

- Transoceanic Abort Landing (TAL) -- Loss of one or more main engines midway through powered flight would force a landing at either Ben Guerir, Morocco; or Moron, Spain.

- Return-To-Launch-Site (RTLS) -- Early shutdown of one or more engines, and without enough energy to reach a TAL site, would result in a pitch around and thrust back toward Kennedy until within gliding distance of the Shuttle Landing Facility.

MISSION SUMMARY TIMELINE

Flight Day One:
Launch/Ascent
OMS-2 Burn
SPACEHAB Activation
RMS Checkout

Flight Day 2:
SPACEHAB Operations
Rendezvous Tool Checkout
Spartan Deploy
IAE Inflation and Jettison
Separation Maneuvers

Flight Day 3:
Spartan Rendezvous and Retrieval
SPACEHAB Operations

Flight Day 4:
SPACEHAB Operations
PAMS-STU Ejection and Initial Separation

Flight Day 5:
SPACEHAB Operations
TEAMS Operations
PAMS-STU Rendezvous Maneuvers

Flight Day 6:
TEAMS Operations
SPACEHAB Operations
Off Duty Time

Flight Day 7:
PAMS-STU Rendezvous and Stationkeeping
Separation Maneuver
SPACEHAB Operations

Flight Day 8:
PAMS-STU Rendezvous, Stationkeeping and Final Separation
SPACEHAB Operations

Flight Day 9:
TEAMS Operations
SPACEHAB Operations
Educational Activities
Crew News Conference

Flight Day 10:
TEAMS Operations
SPACEHAB Operations
Flight Control System Checkout
Reaction Control System Hot-Fire
Cabin Stow

Flight Day 11:
SPACEHAB Deactivation
Deorbit Prep
Deorbit Burn
KSC Landing

STS-77 ORBITAL EVENTS SUMMARY
(Based on a May 16, 1996 Launch)

EVENT	MET	TIME OF DAY (EDT)
Launch	0/00:00	6:32 AM, May 16
OMS-2	0/00:43	7:15 AM, May 16
Spartan-207/IAE Release	1/01:02	7:34 AM, May 17
IAE Inflation	1/03:04	9:36 AM, May 17
IAE Jettison	1/04:34	11:06 AM, May 17
Spartan Grapple	2/04:05	10:37 AM, May 18
PAMS-STU Ejection	2/22:43	5:15 AM, May 19
Crew News Conference	8/01:10	7:42 AM, May 24
Deorbit Burn	9/23:37	6:09 AM, May 26
KSC Landing	10/00:37	7:09 AM, May 26

PAYLOAD AND VEHICLE WEIGHTS

Vehicle/Payload	Pounds
Orbiter (Endeavour) empty and 3 SSME's	152,696
Shuttle System at SRB Ignition	4,519,288
Orbiter Weight at Landing with Cargo	254,879
SPACEHAB Module	8,948
Spartan-207	1,866
Inflatable Antenna Experiment	992
PAMS-STU	115
BETSCE	887
Aquatic Research Facility	117
BRIC	68

CREW RESPONSIBILITIES

Payloads	Prime	Backup
SPACEHAB	Thomas	Garneau
Remote Manipulator System	Garneau	Runco, Thomas
Rendezvous	Casper	Brown, Bursch
Spartan/IAE	Thomas	Runco
TEAMS	Runco	Thomas
PAMS-STU	Runco	Bursch
EVA	Runco (EV 1)	Bursch (EV 2)
Intravehicular Crewmember	Brown	--------
GBA	Garneau	Brown
GANE	Runco	Thomas
Secondaries	Thomas	Garneau
DSO's	Brown	Casper
Earth Observations	Runco	Thomas

Developmental Test Objectives/Detailed Supplementary Objectives

DTO 301D:	Ascent Structural Capability Evaluation
DTO 305D:	Ascent Compartment Venting Evaluation
DTO 306D:	Descent Compartment Venting Evaluation
DTO 307D:	Entry Structural Capability
DTO 312:	External Tank Thermal Protection System Performance
DTO 415:	Water Spray Boiler Electrical Heater Capability
DTO 700-8:	Global Positioning System Development Flight Test
DTO 805:	Crosswind Landing Performance
DSO 331:	LES and Sustained Weightlessness on Egress Locomotion
DSO 487:	Immunological Assessment of Crewmembers
DSO 491:	Characterization of Microbial Transfer Among Crewmembers
DSO 493:	Monitoring Latent Virus Reaction and Shedding in Astronauts
DSO 802:	Educational Activities
DSO 901:	Documentary Television
DSO 902:	Documentary Motion Picture Photography
DSO 903:	Documentary Still Photography

SPARTAN 207/IAE

Spartan 207 (SP207/IAE) is one of the primary payloads on mission STS-77 and the most ambitious Spartan mission to date. The STS-77 crew will deploy and test --as the Spartan spacecraft's sole payload -- the Inflatable Antenna Experiment (IAE).

Managed by Goddard, Spartan is designed to provide short-duration, free-flight opportunities for a variety of scientific studies. The Spartan carrier provides an attitude control system, a data handling and power system, and a thermal control system. A typical Spartan configuration consists of two main pieces of hardware, a Spartan Flight Support Structure (SFSS) and a Spartan free-flyer with the experiment. Part of the SFSS is the Release Engage Mechanism (REM) which allows the free-flyer to be removed from and returned to its berthing position in the Orbiter cargo bay. The free-flyer is deployed and retrieved by the Remote Manipulator System which is operated by an astronaut.

This mission's Spartan configuration is unique in that the IAE is in an additional separate unit that will be ejected once the experiment has completed. Only the Spartan carrier with the experiment recorders will be returned to the cargo bay.

This is the second flight for this Spartan carrier, which flew successfully on STS-63 in February 1995. It is the fifth flight for the cross-bay support structure, and the third for the REM. Overall, STS-77 will be the eighth Spartan mission to fly on the Space Shuttle.

The IAE experiment will lay the groundwork for future technology development in inflatable space structures, which will be launched and then inflated like a balloon on-orbit. This payload will validate the deployment (inflation) and performance of a large inflatable antenna during a ninety-minute sequence before jettisoning the antenna structure and recovering the Spartan spacecraft at sequence end. The inflation process will be captured by the crew, using a variety of still cameras, a motion picture camera, and video cameras. The on-orbit performance of the antenna (surface accuracy) will be determined by illuminating the antenna surface with arrays of lights mounted on the Spartan and capturing the resulting patterns on video recorders aboard the Spartan. These will be analyzed after the Spartan is returned to Earth by the Shuttle.

The IAE is a large inflatable antenna 50 feet (14 meters) in diameter which is mounted on three 92-foot (28 meter) struts. Once in low-Earth orbit, the Spartan will become a platform for the antenna which, when inflated in space, will be roughly the size of a tennis court. The antenna was developed by L'Garde Inc., of Tustin, CA, a small aerospace business, and JPL under NASA's In-Space Technology Experiments Program.

Because the mass and stowed (uninflated) volume of inflatable components is many times less than an equivalent solid structure, inflatable structures have the potential to significantly reduce by 10 to 100 times the cost of future missions using these components. This inflatable antenna weighs only about 132 pounds (60 kilograms) and the operational version may be developed for less than $10 million -- a substantial savings over current mechanically deployable hard structures that may cost as much as $200 million to develop and deliver to space.

Inflatable structures also have the potential to deploy much more reliably than conventional mechanical systems used for deploying rigid structures. In addition, the small packaged size of the inflatable components allows very large structures to be deployed in space with a single small launch vehicle. For example, large space antennas many times the size of today's mechanical orbiting antennas could be used for a variety of applications in space, including satellite antennas for space and mobile communications, Earth observations, astronomical observations, and space-based radar.

The IAE is a prime example of a low-cost technology validation experiment. These experiments are designed to inexpensively test the fundamental performance of a technology in the weightless vacuum of space when it is impossible to do so on the ground. Inflatable systems cannot be evaluated on Earth due to the effects of gravity and atmospheric pressure on the balloon structure. They must be tested on-orbit and the results compared with analytical predictions to achieve the confidence necessary to allow their use in operational systems.

Additionally, the Spartan carrier itself will be implementing new technologies. It will be testing a Solid-State Recorder using flash EEPROM memory, developed under a Small Business Innovative Research contract between Goddard and SEAKR Engineering, Inc. of Englewood, CO. Some of the electronics boxes on the Spartan carrier implemented a Parylene coating process that allows the use of commercial plastic integrated circuits on-orbit.

Experiment and Mission Management

The Spartan project is managed by NASA's Goddard Space Flight Center, Greenbelt, MD, for the Office of Space Science, Washington, DC. IAE is sponsored by NASA's Office of Space Access and Technology, Washington, D.C.

Online Information

Additional information about the Spartan Project is available on the Internet on:

http://sspp.gsfc.nasa.gov/sptnhome.html
or
http://sspp.gsfc.nasa.gov/sp207.html.

Spartan-207 Release and deployment

The Spartan-207 satellite will be deployed on Day two of the mission. Mission Specialist Mario Runco will release the Spartan using the shuttle's mechanical arm, and Commander John Casper will back Endeavour away from the satellite.

Once Endeavour reaches a distance of 400 feet directly in front of the Spartan, Casper will hold Endeavour's position while experiment operations with the Spartan begin. Slightly less than an hour later, Casper will begin a partial flyaround of the satellite, maintaining a distance of about 400 feet, moving to a point directly above Spartan. This partial flyaround will align Endeavour within the transmission direction of the experiment work with the Inflatable Antenna Experiment.

Once Endeavour is directly above Spartan at a distance of 400 feet, the IAE will be inflated. Endeavour will stationkeep 400 feet above Spartan for about an hour and twenty minutes while the IAE is inflated and experiment operations are conducted.

Following those operations, Casper will fire Endeavour's jets to begin separating from the vicinity of the Spartan. The jet firing will initially move Endeavour farther above the satellite, and the shuttle will be about 900 feet away at the time the IAE is jettisoned from Spartan. The jettisoned IAE will move in front of and below than Spartan, while the separation burn performed by Endeavour will move the shuttle above and behind the satellite at a rate of almost two and a half nautical miles per orbit. During the next day, Endeavour will range as much as 40-60 nautical miles behind the satellite before again closing in.

Spartan-207 Rendezvous and Retrieval

Endeavour will return to the vicinity of Spartan-207 on Day three of the mission to retrieve the satellite. The final phase of the rendezvous will begin when Endeavour reaches a point eight nautical miles behind the satellite and the Terminal Phase Initiation burn is performed by the shuttle, putting Endeavour on a course to intercept the Spartan.

As Endeavour closes the final eight nautical miles, there will be an opportunity for four small midcourse correction firings of the shuttle steering jets to fine-tune its course toward Spartan. Also during this time, Garneau will extend the shuttle's mechanical arm into the position for retrieval of the satellite.

Shortly after the fourth and final mid-course correction, Casper will take over manual control of Endeavour's flight. At the time Casper begins manually flying Endeavour, the shuttle will be about 2,500 feet directly below the satellite. Casper will fly the shuttle to a point about 400 feet directly in front of Spartan before closing to within 35 feet. As Casper aligns Endeavour with Spartan,

Garneau will move the mechanical arm into place to lock onto the Spartan grapple fixture. Once captured, Garneau will lower Spartan back into the cargo bay and latch it in place for its return to Earth.

PAMS/STU Deploy and Rendezvous Operations

The Satellite Test Unit (STU), part of the Passive Aerodynamically Stabilized Magnetically Damped Satellite (PAMS) test, will be deployed from Endeavour on Day four of the mission. Although the satellite will not be retrieved, Endeavour will subsequently rendezvous three times with the satellite to acquire satellite attitude information during the rest of the mission.

After STU is ejected from the payload bay, Endeavour will fire its engines to separate from the satellite, aiming to reach a point about eight nautical miles behind STU over the next two orbits. From that point, Endeavour will immediately begin a rendezvous with the satellite, firing its engines in a Terminal Phase Initiation (TI) burn which will put the shuttle on a course to intercept a point about 2,000 feet behind the STU.

As Endeavour closes the eight nautical miles, the shuttle will have the opportunity to perform as many as four small midcourse correction firings, if needed, to fine tune the course toward the satellite. When the shuttle crosses directly behind the STU, Commander John Casper will fire the shuttle steering jets to stationkeep at that position as PAMS experiment operations are performed. Casper will maintain Endeavour at a distance of 2,000-2,300 feet behind the STU for about an hour and forty-five minutes while the experiment work is under way. The experiments will consist of video recordings of the on-orbit attitude of the satellite as it passes through the upper atmosphere of low-Earth orbit. Once the experiment runs are completed, Casper will fire Endeavour's engines to separate from the vicinity of the satellite, putting the shuttle on a course that will have it range as far as 100 nautical miles behind the STU.

Endeavour will revisit the satellite for further attitude measurements on both Day seven and Day eight of the mission, performing the same basic rendezvous, stationkeeping, and separation sequence starting from a point eight nautical miles behind the satellite. During the Day seven and eight operations, Endeavour will stationkeep at a distance of 2,000-2,300 feet behind the STU for about six hours on each day.

SPACE ACCESS AND TECHNOLOGY PAYLOADS

Over 90 percent of the payloads aboard STS-77 are being sponsored by the Office of Space Access and Technology, Washington, DC, through its Commercial Space Centers and their industrial affiliates, and by NASA's Goddard Space Flight Center, Greenbelt, MD, Jet Propulsion Laboratory, Pasadena, CA, Langley Research Center, Hampton, VA, and Lewis Research Center, Cleveland, OH.

Primary payloads include experiments flying aboard the pressurized, commercially-developed SPACEHAB Module; an Inflatable Antenna Experiment to be deployed aboard the free-flying Spartan-207 carrier spacecraft; and a host of four technology experiments known as "TEAMS," housed aboard a "Hitchhiker" carrier mounted in the Shuttle's payload bay.

Additionally, secondary experiments will include a "Brilliant Eyes" cryo-cooling experiment and the joint U.S./Canada aquatic research facility.

SPACEHAB-4

One of the objectives of NASA's Space Technology enterprise is to "use the unique attributes of the space environment to enable industry creation of new and improved products and services." To carry out this objective, NASA's Office of Space Access and Technology sponsors Commercial Space Centers, which are non-profit consortia of industry, academia, and government partners, that foster the use of space for commercial products and services. These payloads primarily reflect the interests and initiatives of industry partners.

In 1990 NASA contracted SPACEHAB, Inc., for the lease of their SPACEHAB Space Research Laboratories for a series of flights. STS-77 marks the fourth flight of the SPACEHAB under this contract and it will carry 10 commercial space product development payloads in the areas of biotechnology, electronic materials, polymers and agriculture as well as several experiments for other NASA payload organizations.

SPACEHAB Module

A SPACEHAB single module will be carrying nearly 3,000 pounds of experiments and support equipment on the STS-77 mission. Twenty-eight lockers, four SPACEHAB soft stowage bags and two single racks will house the experiments and equipment in the module. The SPACEHAB module will be located in the forward portion of Endeavour's payload bay, connected to the middeck by a short tunnel to allow the crew access to the commercial space laboratory.

The module was delivered to NASA on April 3 for installation into Endeavour's payload bay while on Launch Pad 39B. Vertical installation of a SPACEHAB module first occurred on the most recent Shuttle mission, STS-76, and has become the standard method of installation for SPACEHAB modules.

SPACEHAB-4 Experiments

The Advanced Separation Process for Organic Materials (ADSEP) enhances separation technologies for medical products. Separation, purification and classification of cells are limiting factors in biomedical research and pharmaceutical drug development. Advanced separation technology, sponsored by the Consortium for Materials Development in Space at the University of Alabama-Huntsville and developed by Space Hardware Optimization Technology Inc., Floyd Knobs, IN, is designed to foster separation capabilities for terrestrial commercial application and microgravity research. This particular mission, in collaboration with biomedical researchers, will focus on understanding gravitational effects on the manufacture of recombinant hemoglobin products. This area may have significant impact on blood transfusion products where transfusion of hemoglobin rather than whole blood can reduce complications such as blood rejection, infectious disease transmission, and blood contamination in areas without suitable storage capability.

The Commercial Generic Bioprocessing Apparatus (CBGA) will house a number of small test tube-sized fluid mixing syringes controlled at several different temperatures. The versatility of this apparatus allows investigations on a variety of molecular, cellular, tissue and small animal and plant systems. For this flight the apparatus will be configured into four temperature controlled lockers holding 272 individual experiments. Sponsored by Bioserve Space Technologies (NASA's Commercial Center at the University of Colorado, Boulder) a number of specific commercial objectives will be pursued in partnership with several of the Center's industrial affiliates. These will include evaluation of pharmaceutical production of bacterial and fungal systems with Bristol-Myers Squibb, crystallization of oligonucleotides-RNA to gain 3-D structural information for drug design in AIDS research with NeXstar and Amgen, administration of a proprietary chemical to enhance bone marrow macrophage differentiation with Chiron Corp., and tests of a proprietary cell growth inhibitors (cancer research) with Synchrocell, Lockheed Martin and the Kansas State University Research Foundation.

The Plant Generic Bioprocessing Apparatus (PGBA) will be flown for the first time. This two-locker plant growth chamber has been developed by BioServe Space Technologies in collaboration with the Wisconsin Center for Automation and Robotics at the University of Wisconsin - Madison. The plant growth area of the chamber is 12" by 10" with a 10" plant height and 2.5" root depth. In collaboration with Bristol-Myers Sqibb, the commercial goal is to investigate the change in the production of secondary metabolites in microgravity.

Investigations will include the study of Artimisia annua, which produces an antimalarial compound, and Cataranthus roseus, which produces chemotherapeutic compounds. Working with Dean Food, a study will be made of

the effects of space flight on starch, sugar and fatty acid content of special strains of spinach plants. A forestry products company is interested in the lignin production and reaction wood formation in Loblolly pine, and clover plants will be included to study the nitrogen fixation mechanism in microgravity at the behest of Research Seeds, Inc. While a nine-day mission is not very long for plant growth, the sponsoring affiliates hope to establish the potential for long duration missions to benefit development of new products derived from plants.

The Fluids Generic Bioprocessing Apparatus-2 (FGBA-2) payload represents an evolutionary step in carbonated fluids management technology. For the Coca-Cola Company, the primary corporate sponsor, FGBA-2 will provide a test bed to determine if carbonated beverages can be produced from separately stored carbon dioxide, water and flavored syrups and determine if the resulting fluids can be made available for consumption without bubble nucleation and resulting foam formation. Coca-Cola also will be verifying and obtaining additional data on the effects of space flight on changes in taste perception. Such data might aid in understanding altered tastes in specific target populations on Earth, such as the elderly, and eventually lead to altered beverage formulations that could increase hydration for such individuals and for astronauts. The sponsor--BioServe Space Technologies--is using the technology and lessons learned from this mission to apply to other commercial space life sciences activities including the development of plant growth and cell culture biotechnology facilities, closed environment research facilities and other projects that require management of two-phase fluids. Payload health and engineering data will be collected along with video images documenting behavior of the carbonated beverages during transfer operations.

The IMMUNE-3 experiment is a commercial middeck payload sponsored by BioServe Space Technologies and Kansas State University, Manhattan. The corporate affiliate leading the IMMUNE-3 investigation is Chiron Corp., Emeryville, CA. NASA's Ames Research Center, Mountain View, CA, provides payload and mission integration support.

The goal is to test the ability of Insulin-like Growth Factor to prevent or reduce the detrimental effects of space flight on the immune and skeletal systems of rats. Space flight has been shown to induce alterations in immune responses and reductions in skeletal development in rats; this may model immune disorders and impaired skeletal development on Earth. A demonstrated ability to counter reduced bone formation and immune system impairment accompanying spaceflight may provide new product markets for Chiron on Earth and a future therapeutic for long-term space missions.

Along with extensive ground-based research, acquired knowledge could be used to develop protocols designed to protect the immune systems of patients undergoing chemotherapy or radiotherapy, to treat patients with AIDS, primary immune-deficiency and a broad range of infectious diseases. The applications toward a variety of bone disorders are currently under investigation, and should be aided by the findings of this flight investigation.

Three Commercial Protein Crystal Growth investigations on this flight will use three techniques. One is a process driven by temperature change that will produce crystals of a new form of recombinant human insulin provided by Eli Lilly; the other uses vapor diffusion to crystallize different proteins with objectives that address a range of diseases. The insulin crystals will support a better understanding of the protein's structure to help Eli Lilly, an affiliate of the Center for Macromolecular Crystallography --a NASA Commercial Space Center at the University of Alabama, Birmingham--understand the mode of action of this new form of insulin. The microgravity environment helps to produce large, well-ordered protein crystals that can be used for x-ray diffraction studies to determine the three-dimensional structures of the individual proteins. Knowledge of these structures can facilitate the development of new or more effective pharmaceuticals to combat diseases.

The vapor diffusion experiments will use flight hardware that is an improved adaptation of the most common laboratory method for growing protein crystals. It will provide for 128 individual experiments. The temperature driven hardware will use sample holders of different volumes, with different temperature gradients, to test systems that provide industry with more operational flexibility, and allow smaller amounts of expensive sample materials.

Gas Permeable Polymer Membrane (GPPM) is flying the third in the series of flights to use microgravity for development of enhanced polymers for manufacture of improved rigid gas permeable contact lenses. Polymer development of lens material in microgravity has shown polymers can be formed that will have greater uniformity of structure, increased gas permeability allowing greater oxygen flow for improved comfort to wearers, greater durability of material, and greater machinability in the manufacture process. NASA's Langley Research Center, Hampton, VA, and Paragon Vision Sciences of Phoenix, AZ, are the partners in this commercial research effort.

Four Handheld Diffusion Test Cell (HHDTC) experiment units each containing eight test cells will grow protein crystals by diffusing one liquid into another. In liquid-liquid diffusion, different fluids are brought into contact but not mixed. Over time, the fluids will diffuse into each other through random motion of molecules. The gradual increase in concentration of the precipitant within the protein solution causes the proteins to crystallize. Liquid-liquid diffusion is difficult on Earth because differences in solution densities allow mixing by gravity-driven thermal convection. In addition, the greater density of the crystals allows them to settle into inappropriate parts of the cell.

The proteins that will be grown in microgravity include: lysozyme, catalase, concanavalin b, cnavalin, myoglobin, thaumatin, ferritin, apoferritin, satellite tobacco mosaic virus and turnip yellow mosaic virus

Commercial Float Zone Furnace (CFZF) experiments have the goal of producing large, ultra-pure compound semiconductor and mixed oxide crystals for electronic devices and infrared detectors. Three international agencies are cooperating on the project: NASA Marshall Space Flight Center, Huntsville, AL,

the Canadian Space Agency (CSA) and the German Space Agency (DARA). The U.S. samples of gallium arsenide (GaAs) and gallium antinomide (GaSb) have been prepared by the University of Florida in cooperation with industrial participant Atramet, Inc. A liquid encapsulate around the float zone to promote the growth of a larger crystal in the microgravity environment will be used. This technique was investigated on the first SPACEHAB mission in 1993. The parabolic-ellipsoid mirror type furnace is provided by the CSA and DARA. The furnace flew on the D-2 Spacelab mission in 1993. Telescience will be used during the mission to enable researchers on the ground to view and/or control the melts and work with the astronauts to control the melts.

The Space Experiment Facility (SEF), developed and managed by The University of Alabama in Huntsville's Consortium for Materials Development in Space will house a crystal growth experiment and a metals experiment.

The crystal growth experiment, which will use the SEF's transparent furnace, will focus on mercurous chloride a valuable electro-optic material of commercial interest. Larger and higher quality mercurous chloride crystals could improve devices used in spectral imaging.

The metals experiment, conducted in SEF's opaque furnace, will use liquid phase sintering (LPS) to bond powdered metals. LPS may provide greater understanding of alloy behavior and porosity on these metal composites. One area that could potentially benefit from improved metal composites is the machine tool industry.

The NIH-C7 experiment continues the collaboration between NASA and the National Institutes of Health (NIH). It is a middeck-locker experiment that will repeat and augment previously flown experiments investigating the effect of space flight on musculoskeletal development at the cellular level.

The experiment payload consists of two biomedical studies sponsored by NASA and NIH. These experiments will use a computerized tissue culture incubator known as the Space Tissue Loss Culture Module. The module was developed at the Walter Reed Army Institute of Research, Washington, DC, to study cells in microgravity.

The experiments will study the effects of space flight on muscle and bone cells from chicken embryos. The experiments on STS-77 will augment data from a previous flight in November 1994. Results of this research may lead to development of measures to maintain the strength of muscles and bones during long-duration space voyages and may provide insights and health benefits for people on Earth as well.

The scientific objective of the NIH/NASA collaboration is to investigate fundamental biological processes governing cell action under different levels of gravity. The effects of space flight on bone cells, specifically the calcification and developmental activity in maturing cartilage cells will be examined.

The effects of space flight on muscles to determine if microgravity causes damage or loss of muscle fibers, using special markers of cell damage, growth assays, measurements of muscle size and multiple biochemical assessments also will be studied.

TECHNOLOGY EXPERIMENTS FOR ADVANCING MISSIONS IN SPACE (TEAMS)

Inside the Space Shuttle Endeavour's payload Hitchhiker (HH) experiment carrier managed by the Goddard Space Flight Center will be four experiments called Technology Experiments for Advancing Missions in Space (TEAMS).

These experiments will include: The Global Positioning System (GPS) Attitude and Navigation Experiment (GANE); the Vented Tank Resupply Experiment (VTRE); the Liquid Metal Thermal Experiment (LMTE); and the Passive Aerodynamically Stabilized Magnetically Damped Satellite (PAMS). The experiments are flown together at reduced cost and with the Hitchhiker carrier providing the needed resources (power, data, etc.) to each experiment

The Hitchhiker carrier can carry equipment mounted in canisters and also has mounting plates of various sizes for user equipment. The carrier provides electrical power, command signals, and "downlink" data interfaces. Hitchhiker customers operate their payloads from a Goddard control center using their own ground support equipment (usually a personal computer) to send commands and display data.

Global Positioning System (GPS) Attitude and Navigation Experiment (GANE) Johnson Space Flight Center (JSC), Houston, Texas

The Global Positioning System is a Department of Defense navigation system that allows world-wide navigation capabilities. GPS is becoming the world standard navigation system that allows anyone anywhere to know their position within 100 meters or less. Pilots, boaters hikers, and just about anyone can use this system for accurate real-time position and velocity determination.

One unique aspect of GPS is its capability for determining the attitude of a vehicle using three or four antennas, and measuring the GPS carrier phase through each antenna. This technique has been successfully tested on surface vehicles and aircraft, but it has not been tested in space before.

The International Space Station will use GPS not only for position, velocity, and time information but attitude determination as well. To assure GPS attitude can be measured to 0.1 degrees or less per axis of rotation, a flight experiment aboard the shuttle was proposed in 1994. This flight experiment will fly commercial off-the-shelf equipment and Station supplied equipment to determine the accuracy with which GPS derived attitude can be measured in an orbital environment.

Vented Tank Resupply Experiment (VTRE) NASA Lewis Research Center, Cleveland, Ohio

The Vented Tank Resupply Experiment (VTRE) is to test improved methods for in-space refueling. The results of the experiment will be used in future designs of spacecraft liquid storage tanks. This experiment is the responsibility of the Lewis Research Center in Cleveland, Ohio, with Lockheed Martin as contractor.

When a spacecraft stays in space for long periods, such as the planned International Space Station, they need to be resupplied. This includes resupplying everything from rocket propellant to drinking water. The VTRE will primarily test technologies for using a vented fill method in space. In a vented fill, vapor is allowed to vent from the tank to make room for the incoming liquid. This is a common method as familiar as pouring coffee into a cup or gasoline into a gas tank. In space, however, the near total absence of gravity complicates the process.

The key VTRE component undergoing test is the Capillary Acquisition Vane, a set of flat panels inside the tank that keep the liquid away from the tank vent tap. These simple devices take advantage of a liquid surface tension or capillary action, a property that makes liquids adhere to solid surfaces and wick into small crevasses. The vanes are designed to accumulate the liquid where the liquid tap is located and provide a vapor pocket where the venting tap is located. Capillary Acquisition Vanes have been successfully used for years as liquid acquisition devices for rocket propellant, but their ability to vent vapor without venting any liquid remains to be demonstrated.

Passive Aerodynamically Stabilized Magnetically Damped Satellite (PAMS), Goddard Space Flight Center, Greenbelt, MD

The Goddard Space Flight Center's Passive Aerodynamically Stabilized Magnetically Damped Satellite(PAMS) experiment is a technology demonstration of the principle of aerodynamic stabilization. PAMS consists of a small deployed satellite and a measuring system to observe the satellite during a shuttle mission.

Aerodynamic stabilization is a method that can be used to position a satellite in a specific orientation while in low Earth orbit. Aerodynamic stabilization works the same way as a dart. The front of the dart is weighted and once the dart is thrown, it will always right itself with the head facing forward. In the same manner, the PAMS satellite will eventually be oriented with the heavy end facing forward in orbit. This principle can be used to partially control the attitude of small satellites.

Cameras on the shuttle will record the satellite as it is deployed. Later during the flight, the shuttle will rendezvous with the satellite on two separate days. The Shuttle will trail 2,000 feet behind the satellite and point the PAMS measuring system. The cameras aboard the Shuttle will record the satellite movements over eight orbits.

Liquid Metal Thermal Experiment (LMTE)
Air Force Phillips Laboratory

The purpose of the Liquid Metal Thermal Experiment (LMTE) is to evaluate the performance of liquid metal heat pipes in microgravity conditions.

Heat pipes are thermal management devices used on many existing and planned space systems for the purpose of waste heat removal. In their simplest form, they consist of a tube containing a porous wicking material saturated with a working fluid. During operation, the fluid alternately vaporizes and condenses at different ends of the pipe as it absorbs and releases the waste heat.

Many different kinds of fluids are used including ammonia, oxygen, and potassium depending on the desired operation temperatures. The three LMTE heat pipes contain potassium and are designed to operate at 300 to 1000 degrees Celsius. Heat pipes in this high temperature range have never been operated in microgravity conditions. The operational characteristics of liquid metals in space are, therefore, not well understood. The data obtained from LMTE will be invaluable to space system designers requiring high temperature heat rejection.

LMTE is sponsored by the Air Force Phillips Laboratory, Albuquerque, NM, with support from the Air Force Space Test Program.

SECONDARY EXPERIMENTS

The **Brilliant Eyes Ten Kelvin Sorption Cryocooler Experiment (BETSCE)** is a microgravity experiment carrying an instrument that can quickly cool infrared and other sensors to near absolute zero.

Developed at NASA's Jet Propulsion Laboratory (JPL), Pasadena, CA, it will be used to cool infrared sensors aboard spacecraft to 10 degrees Kelvin, or -441.6 degrees Fahrenheit. (Absolute zero is -459.6 F).

BETSCE is a space shuttle technology demonstration experiment to show that cryocoolers of this type, called "sorption coolers", can operate in the absence of gravity. Sorption coolers have essentially no vibration, are very efficient at these cold temperatures, and can operate reliably for over 10 years.

Sorption coolers work by using specialized metal alloy powders, called metal hydrides, that absorb the hydrogen refrigerant through means of a reversible chemical reaction. In the sorption compressor, the metal powder is first heated to release and pressurize the hydrogen, and then cooled to room temperature to absorb hydrogen and reduce its pressure. By sequentially heating and cooling the powder, the hydrogen is circulated through the refrigeration cycle. Ten degrees Kelvin is achieved by expanding the pressurized hydrogen at the cold tip of the refrigerator. This expansion actually

freezes the hydrogen to produce a solid ice cube at 10 degrees Kelvin. The heat load generated by the device being cooled then sublimates the ice. This closed cycle operation is repeated over and over.

Nothing moves in the compressor so it doesn't vibrate and tend to wear out like conventional refrigerator compressors that contain moving pistons that rub. The absence of vibration is an important quality needed for spacecraft and instruments such as infrared astronomical telescopes that need a precision pointing capability or a mechanically quiet platform on which to operate.

Before this new technology, the only way to achieve temperatures in space as low as 10 degrees Kelvin has been to launch extremely large, heavy, and expensive dewars containing liquid helium or solid hydrogen. Unfortunately, these dewars have very limited lifetimes because the cryogens eventually get boiled off and become depleted. The ability to achieve a lifetime of ten or more years, with no vibration, opens the door to a wide variety of future missions that could benefit from this novel technology. Sorption coolers are currently baselined on several missions, including the recently proposed Primordial Structure Investigation (PSI) mission, and have been proposed for a variety of future infrared astrophysics missions such as the Next Generation Space Telescope and spaceborne interferometers.

BETSCE experiment development was funded by the Air Force Space and Missiles System Center and the Department of Defense's Ballistic Missile Defense Organization (BMDO). NASA's Office of Space Access and Technology (OSAT) is sponsoring the Shuttle flight for BETSCE.

The **Aquatic Research Facility (ARF)** is a joint Canadian Space Agency (CSA)/NASA project with CSA providing flight hardware, NASA providing flight opportunities, and both agencies sharing in the scientific investigations. This is the first flight of ARF, a Canadian designed and built middeck payload which allows sophisticated investigations of a wide range of small aquatic species. The facility will permit scientists to investigate the process of fertilization, embryo formation and differentiation, development of calcified tissue and feeding behaviors of small aquatic organisms.

The facilities three experiments will provide an integrated international investigation of early development and ocean ecology: Dr. Bruce Crawford of the University of British Columbia will study developing starfish embryos until they are able to orient and feed themselves. Dr. Ron O'Dor of Dalhousie University will study advanced stages of bi-valves (mussels), focusing on the development of adult tissue structure, calcium deposition/loss and feeding behavior. Dr. Heidi Schatten of the University of Wisconsin - Madison will investigate the effects of gravity on sea urchin fertilization and early embryo differentiation and development. This research will potentially improve the way scientists model human development, as well as the factors which may disrupt it.

The **Biological Research In a Canister (BRIC) 07** is the subject of research for NASA at the University of Arizona, Tucson, AZ.

Spaceflight has been shown to effect the endocrine system of crewmembers. This study will aid in the discovery of the mechanism(s) behind one endocrine system in insects which may aid in research on endocrine systems in general, including human systems.

In addition to the principal investigator and NASA staff, college undergraduates, high school students and an elementary school teacher are involved in the project. Specific activities include an outreach program in Tucson, AZ that has elementary school kids excited about science the space program, and this project in particular.

The experimental procedures begin with the pupa, at 5 to 65 hours after development commences. The pupa will be placed in the BRIC canisters and loaded onto the Orbiter. No inflight manipulation or procedures are required. Postflight, all pupae will be examined morphologically. Half to two-thirds of the pupa will be sacrificed for hemolymph collection for amino acid and analysis of the hormone ecdysone. The remaining pupa will be transported back to the PI's lab and monitored for development to adulthood. During the last 24 hours before adult emergence, the dorsolongitudinal flight muscle will be excised and analyzed for protein content and concentration.

BRIC experiments are sponsored by NASA's Office of Life and Microgravity Sciences and Applications.

[redacted]

The GAS project is managed by NASA's Goddard Space Flight Center, Greenbelt, MD. NASA began flying these small self-contained payloads in 1982. The project gives individuals or organizations an opportunity to perform experiments in space on the Space Shuttle.

Customer: California Institute of Technology, Pasadena, CA
G-056

Caltech's Gamma-ray Astrophysics Mission (GAMCIT) payload is the first space payload built by Caltech's chapter of the Students for the Exploration and Development of Space (SEDS), GAMCIT, originally designed by Astronaut John Grunsfeld, will study an enigmatic source of cosmic radiation known as gamma ray bursts. While these intense bursts of high-energy radiation were first discovered in the late 1960s by satellites watching for clandestine nuclear tests, their precise nature and origin still remains an intriguing astrophysical mystery.

Customer: German Space Agency
G-142 and G-144

The German Space Agency (DARA) is flying two payloads. The experiments are called MAUS, a German acronym for autonomous material science experiments under microgravity. It is one of the programs for flight opportunities the Federal Republic of Germany offers scientists from disciplines of material research and processing to perform material science investigations under microgravity conditions. These experiments were developed by scientists from the Technical University of Munich and the Technical University of Clausthal.

Diffusion Coefficient Measurement Facility (DCMF)
G-163

The Diffusion Coefficient Measurement Facility (DCMF) will measure the speed at which Mercuric Iodide (solid) is evaporated and then transported as a vapor under microgravity conditions.

Customer: Utah State University
G-200

Three experiments are being flown in canister G-200. In addition, the payload will contain popcorn kernels in zip lock bags as an experiment by an elementary school. After being flown, students will pop the popcorn and compare it with a similar sample maintained in one gravity.

Customer: British Sugar plc.
G-490

This experiment was designed and constructed by the School of Electronics and Electrical Engineering in the Robert Gordon University, Aberdeen, Scotland. The launch services were sponsored by British Sugar plc.

The payload carries two main experiments. The first investigation is to verify a proposal that low-level gravitational field can be measured by observing their effect on the convection currents present in a heated liquid.

The second project has been devised by a group of children from Elrick Primary School near Aberdeen. A series of controlled experiments are being carried out on selected samples of seeds, oats, wheat, barley and nape-oil to quantify the effects of space flight on growth patterns.

Customer: Canadian Space Agency
G-564 and G-565

The Canadian Space Agency (CSA) will fly experiments in two GAS canisters, Nanocrystal Get Away Special (NANO-GAS) and Atlantic Canada Thin Organic Semiconductors (ACTORS). The results of these experiments may lead to the development of new materials with applications in high performance lasers and in electronic equipment and components. Canadian astronaut Marc Garneau will be on board this mission to assist in monitoring the operation of these experiments in his role as mission specialist.

Customer: NASA Lewis Research Center
G-703

The Microgravity Smoldering Combustion (MSC) experiment studies the smolder characteristics of porous combustible materials in a microgravity environment. Smoldering is a non-flaming form of combustion that takes place in the interior of porous combustible materials. The propagation of the smolder reaction is controlled by complex thermos-chemical mechanisms, which are not well understood. The experiment objective is to provide a better understanding of these controlling mechanisms, both in microgravity and Earth gravity.

Customer: NASA Lewis Research Center
G-741

The G-741 experiment is an extension of the study of the fundamentals of nucleate pool boiling heat transfer under the microgravity conditions of space. An improved understanding of the basic processes that constitute boiling is sought by removing the buoyancy effects which mask other phenomena. The canister consists of two reflight experiments which propose to broaden the range of experimental parameters beyond those covered previously in order to study an element involved in the boiling process which, as a result of the experimental work in microgravity conducted to date, appears to play a significant role in pool boiling - that of dryout and its reverse - wetting.

Tank Pressure Control Experiment/Reduced Fill Level (TPCE/RFL)

An important issue in microgravity fluid management is controlling pressure in on-orbit storage tanks for crogenic propellants and life support fluids, particularly liquid hydrogen, oxygen and nitrogen. The purpose of the Tank Pressure Control Experiment/Reduced Fill Level (TPCE/RFL) is to provide some of the data required to develop the technology for pressure control of cryogenic tankage.

This STS-77 experiment will investigate pressure rise rates and pressure control (using a mixer) for tanks that are approximately 40 percent full of oxygen (Freon 113). These conditions simulate those encountered by multiple-burn cryogenic stages used for lunar or planetary exploration. Although the pressure rise rates are expected to be lower for the reduced fill level tanks, the

ability of the jet mixer to effectively cool all regions of the tank is of great interest.

TPCE/RFL uses flight hardware previously developed by the Boeing Defense and Space Group under NASA's In-Space Technology Experiments activity. The flight hardware is on loan from the NASA Lewis Research Center.

STS-77 CREW BIOGRAPHIES

John H. Casper (Colonel, USAF) will serve as Commander for STS-77. Casper was born July 9, 1943, in Greenville, SC, but considers Gainesville, GA, to be his hometown. He graduated from Chamblee High School, Chamblee, Georgia, in 1961; received a bachelor's of science degree in engineering science from the U.S. Air Force Academy in 1966, and a master's of science degree in astronautics from Purdue University in 1967. He also is a 1986 graduate of the Air Force Air War College.

Casper was selected by NASA in May 1984 and became an astronaut in June 1985. A veteran of three space flights, STS-36 in 1990, STS-54 in 1993, and STS-62 in 1994, Casper has logged over 585 hours in space.

Curtis L. Brown, Jr. (Lieutenant Colonel, USAF) will serve as the Pilot for Mission STS-77. Brown was born March 11, 1956, in Elizabethtown, NC. He graduated from East Bladen High School, Elizabethtown, NC, in 1974 and received a bachelor's of science degree in electrical engineering from the Air Force Academy in 1978.

Brown was selected as an astronaut candidate by NASA in June 1987 and completed a one-year training and evaluation program in August 1988 which qualified him for assignment as a pilot on future Space Shuttle flight crews. A veteran of two space flights, Brown has logged over 453 hours in space. He was the pilot on STS-47 in 1992, and STS-66 in 1994.

Andrew S. W. Thomas (Ph.D.) will serve as Mission Specialist-1 on the STS-77 mission. Thomas was born December 18, 1951, in Adelaide, South Australia. He received a bachelor's of engineering degree in mechanical engineering, with First Class Honors, from the University of Adelaide, South Australia, in 1973, and a doctorate in mechanical engineering from the University of Adelaide, South Australia, in 1978.

Thomas was selected by NASA in March 1992 and reported to the Johnson Space Center in August 1992. In August 1993, following one year of training, he was appointed a member of the astronaut corps and qualified for assignment as a mission specialist on Space Shuttle flight crews. STS-77 will be Thomas' first space flight.

Daniel W. Bursch (Commander, USN) will serve as Mission Specialist-2 during the STS-77 mission. Bursch was born July 25, 1957, in Bristol, PA, but considers Vestal, NY, to be his hometown. He graduated from Vestal Senior High School, Vestal, NY, in 1975; received a bachelor's of science degree in physics from the United States Naval Academy in 1979, and a master's of science degree in engineering science from the Naval Postgraduate School in 1991.

Bursch was selected by NASA in January 1990 and became an astronaut in July 1991. A veteran of two space flights, Bursch has logged over 505 hours in space. He served as a mission specialist on STS-51 in 1993, and STS-68 in 1994.

Mario Runco, Jr. will serve as Mission Specialist-3 on the STS-77 mission. Runco was born January 26, 1952, in the Bronx, NY, but considers Yonkers, NY, to be his hometown. He graduated from Cardinal Hayes High School, Bronx, NY, in 1970; received a bachelor's of science degree in meteorology and physical oceanography from the City College of New York in 1974, and a master's of science degree in meteorology from Rutgers University, New Brunswick, NJ, in 1976.

Runco was selected by NASA as an astronaut candidate in June 1987 and qualified for assignment as an astronaut mission specialist in August of 1988. A veteran of two space flights, STS-44 in 1991 and STS-54 in 1993, Runco has logged over 310 hours in space.

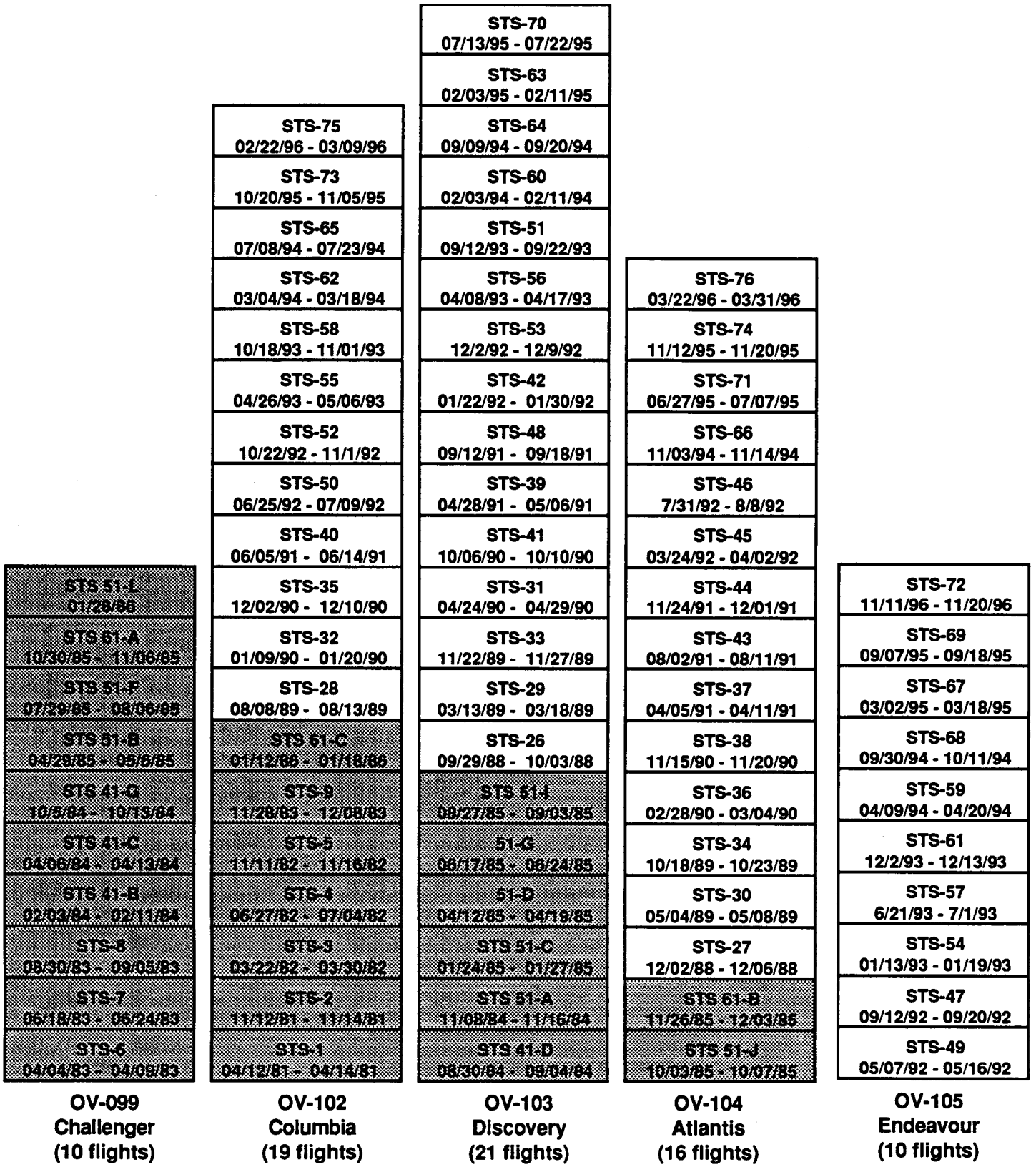
Marc Garneau (Ph.D.) is a member of the Canadian Space Agency (CSA) and will serve as Mission Specialist-4 on the STS-77 mission. Garneau was born February 23, 1949, in Quebec City, Canada. He attended primary and secondary schools in Quebec City & Saint-Jean, Quebec, and in London, England. He received a bachelor's of science degree in engineering physics from the Royal Military College of Kingston in 1970, and a doctorate in electrical engineering from the Imperial College of Science and Technology, London, England, in 1973. Garneau attended the Canadian Forces Command and Staff College of Toronto in 1982-83.

Garneau was one of six Canadian astronauts selected in December 1983 and flew as a payload specialist on Shuttle Mission 41-G in October 1984. In July 1992 Garneau was selected for astronaut candidate training and following one year of training, he was appointed a member of the astronaut corps and qualified for assignment as a mission specialist on Space Shuttle flight crews. Garneau has logged over 197 hours in space.

For complete biographical information on NASA astronauts, see the NASA Internet astronaut biography home page at address: http://www.jsc.nasa.gov/Bios/

SHUTTLE FLIGHTS AS OF APRIL 1996

76 TOTAL FLIGHTS OF THE SHUTTLE SYSTEM – 51 SINCE RETURN TO FLIGHT



UPCOMING SHUTTLE MISSIONS

MISSION	ORBITER	MAJOR PAYLOADS	TARGET DATE	MISSION DURATION
STS-78	COLUMBIA	Life & Microgravity Sciences	JUNE 20, 1996 10:49 a.m. EDT	14+2 Days
STS-79	ATLANTIS	Shuttle-Mir Mission-4	AUG. 1, 1996 11:42 p.m. EDT (7/31/96)	9+1 Days
STS-80	COLUMBIA	ORFEUS-SPAS WSF	NOV. 7, 1996	16 Days
STS-81	ATLANTIS	Shuttle-Mir Mission-5	DEC. 5, 1996	9+1 Days
STS-82	DISCOVERY	Hubble Space Telescope-Servicing Mission-2	FEB. 13, 1997	10 Days
STS-83	COLUMBIA	Microgravity Science Laboratory-1	MAR. 27. 1997	16 Days
STS-84	ATLANTIS	Shuttle-Mir Mission-6	MAY 1, 1997	9+1 Days
STS-85	DISCOVERY	CRISTA-SPAS-2 MFD, TAS, IEH	JULY 17, 1997	11+1 Days
STS-86	ATLANTIS	Shuttle-Mir Mission-7	SEPT. 11, 1997	9+1 Days

Note: The above information is subject to change. It is based on current assessed target launch dates used as a part of processing and planning activities for upcoming Shuttle missions. The official launch date for a mission is set at the Flight Readiness Review meeting held approximately 2 weeks before launch.

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

Deanna Corridon
Headquarters, Washington, DC
(Phone: 202/358-1733)

For Release

May 1, 1996

VIDEO ADVISORY: V96-48

THESEUS PREPARED FOR FIRST TAXI TEST, NASA'S HUBBLE SPACE TELESCOPE REVEALS IMAGES OF SATURN ON NTV WEDNESDAY

On Wednesday NASA TV will televise footage of the Theseus robotic prototype aircraft which has been shipped to the Dryden Flight Research Center, Edwards, CA, for preparation of its first taxi test. Theseus has the potential to support NASA's Mission to Planet Earth by carrying atmospheric sensors to remote areas where satellites are unable to reach on long duration missions. NTV also will transmit a series of images captured by the Hubble Space Telescope. The first image shows a rare view of Saturn's rings during a sunset, and the remaining images reveal some of the small moons orbiting around Saturn. Replaying on NTV will be two SIR-C images showing urbanization and potential areas for mineral exploration, animation of the STS-77 mission, and interviews with astronaut Shannon Lucid aboard the Mir Space Station.

ITEM #1: THESEUS, ROBOTIC AIRCRAFT
Theseus gets prepared for first taxi test.

ITEM #2: INTERVIEW - MATT HUTCHISON, THESEUS PROJECT MANAGER
Interview with Theseus Project Manager, Aurora Flight Sciences Corp.

ITEM #3: INTERVIEW - JOHN LANGFORD, PRESIDENT AURORA FLIGHT SCIENCE CORP.
Interview with President of Aurora Flight Science Corp. on Theseus Project.

ITEM #4: SUNSET ON SATURN'S RING
View of Saturn's rings seen after a sunset.

ITEM #5: MOONS AROUND SATURN
Series of 10 images showing orbiting moons around Saturn.

ITEM #6: REPLAY - ORANGE COUNTY URBANIZATION

ITEM #7: REPLAY - MINERAL RESOURCES

ITEM #8: REPLAY - STS-77 ANIMATION

ITEM #9: REPLAY - INTERVIEW WITH SHANNON LUCID (4/30/96)
Discussion regarding life on Mir with KABC and WTTG.

Video news files air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

May 1, 1996

Ed Campion
Headquarters, Washington, DC
(Phone: 202/358-1778)

Kyle Herring
Johnson Space Center, Houston, TX
(Phone: 713/483-5111)

RELEASE: 96-84

NASA SELECTS ASTRONAUT CLASS OF 1996

Thirty-five astronaut candidates will arrive at the Johnson Space Center on August 12 to begin a period of training and evaluation.

This year's class consists of 10 pilot and 25 mission specialist candidates selected from more than 2,400 applicants. The class of 1996 is the largest class selected since the first class of Shuttle astronauts, also numbering 35, was named in 1978.

Following approximately one-year of evaluation and training, the astronauts will receive technical assignments within the Astronaut Office to further prepare them for Shuttle flight assignments.

A listing of the candidates and their biographical data follows:

-more-

BIOGRAPHICAL DATA

NAME: David M. Brown, Commander, USN, Mission Specialist
BIRTHDATE/PLACE: April 16, 1956 - Arlington, VA
RESIDENCE: Ridge, MD
EDUCATION: Yorktown High School, Arlington, VA, 1974
B.S., Biology, College of William and Mary, 1978
M.D., Eastern Virginia Medical School, 1982
CURRENT POSITION: Flight Surgeon
U.S. Naval Test Pilot School
Naval Air Station
Patuxent River, MD
PARENTS: Paul D. and Dorothy R. Brown, Washington, VA
MARITAL STATUS: Unmarried

NAME: Daniel C. Burbank, Lieutenant Commander, USCG, Mission Specialist
BIRTHDATE/PLACE: July 27, 1961 - Manchester, CT
RESIDENCE: Sitka, AK
EDUCATION: Tolland High School, Tolland, CT, 1979
B.S., Electrical Engineering, U.S. Coast Guard Academy, 1985
M.S., Aeronautical Science, Embry-Riddle Aeronautical University, 1990
CURRENT POSITION: Aeronautical Engineering Officer/Aviator
U.S. Coast Guard Air Station
Sitka, AK
PARENTS: Daniel L. and Joan G. Burbank, Tolland, CT
MARITAL STATUS: Married to the former Roslyn D. Bowman

NAME: Yvonne D. Cagle, M.D., Mission Specialist
BIRTHDATE/PLACE: April 24, 1959 - West Point, NY
RESIDENCE: Houston, TX
EDUCATION: Novato High School, Novato, CA, 1977
B.A., Biochemistry, San Fransciso State University, 1981
M.D., University of Washington, 1985
CURRENT POSITION: Occupational Medicine Physician/Deputy Project Manager
Kelsey-Seybold Clinic
NASA Johnson Space Center
Houston, TX
PARENTS: George D. and Betsy J. Cagle, Novato, CA
MARITAL STATUS: Unmarried

NAME: Fernando (Frank) Caldeiro, Mission Specialist
BIRTHDATE/PLACE: June 12, 1958 - Buenos Aires, Argentina
RESIDENCE: Merritt Island, FL
EDUCATION: W.C. Bryant High School, Long Island City, NY, 1976
B.S., Mechanical Engineering, University of Arizona, 1984
M.S., Engineering Management, University of Central Florida, 1995
CURRENT POSITION: Aerospace/Shuttle Systems Engineer
NASA Kennedy Space Center
Kennedy Space Center, FL
PARENTS: Jose A. and Carmen D. Caldeiro, Flushing, NY
MARITAL STATUS: Married to the former Donna M. Emero

NAME: Charles J. Camarda, Ph.D., Mission Specialist
BIRTHDATE/PLACE: May 8, 1952 - New York, NY
RESIDENCE: Virginia Beach, VA
EDUCATION: Archbishop Molloy High School, Jamaica, NY, 1970
B.S., Aerospace Engineering, Polytechnic Institute of New York, 1974
M.S., Engineering Science, George Washington University, 1980
Ph.D., Aerospace Engineering, Virginia Polytechnic Institute and State University, 1990
CURRENT POSITION: Head-Thermal Structures Branch
NASA Langley Research Center
Hampton, VA
PARENTS: Jack and Ray Camarda, Queens, NY
MARITAL STATUS: Unmarried

NAME: Duane G. Carey, Major, USAF, Pilot
BIRTHDATE/PLACE: April 30, 1957 - St. Paul, MN
RESIDENCE: Edwards, CA
EDUCATION: Highland Park High School, St. Paul, MN, 1975
B.S., Aerospace Engineering and Mechanics, University of Minnesota-Minneapolis, 1981
M.S. Aerospace Engineering, University of Minnesota-Minneapolis, 1982
CURRENT POSITION: System Safety Officer/Experimental Test Pilot
416th Flight Test Squadron, Edwards AFB, CA
PARENTS: Claire D. and Penny L. Pastorius, Minneapolis, MN
MARITAL STATUS: Married to the former Cheryl A. Tobritzhofer

NAME: Laurel B. Clark, Lieutenant Commander, USN, Mission Specialist
BIRTHDATE/PLACE: March 10, 1961 - Ames, IA
RESIDENCE: Pensacola, FL
EDUCATION: William Horlick High School, Racine, WI, 1979
B.S., Zoology, University of Wisconsin-Madison, 1983
M.D., University of Wisconsin-Madison, 1987
CURRENT POSITION: Flight Surgeon
Training Air Wing SIX, Pensacola, FL
PARENTS: Robert L. and Harriet G. Salton, Albuquerque, NM
Richard J.C. and Margory B. Brown, Racine, WI
MARITAL STATUS: Married to Jonathan B. Clark

NAME: Edward M. Fincke, Captain, USAF, Mission Specialist
BIRTHDATE/PLACE: March 14, 1967 - Pittsburgh, PA
RESIDENCE: Gifu AB, Japan
EDUCATION: Sewickley Academy, Sewickley, PA, 1985
B.S., Aeronautics and Astronautics and Earth Atmospheric, and Planetary Sciences, Massachusetts Institute of Technology, 1989
M.S., Aeronautics and Astronautics, Stanford University, 1990
CURRENT POSITION: XF-2 Flight Test Liaison
XF-2 Flight Test Operations, Gifu AB, Japan
PARENTS: Edward V. and Alma J. Fincke, Emsworth, PA
MARITAL STATUS: Unmarried

-more-

NAME: Patrick G. Forrester, Lieutenant Colonel, USA, Mission Specialist
BIRTHDATE/PLACE: March 31, 1957 - El Paso, TX
RESIDENCE: Houston, TX
EDUCATION: West Springfield High School, Springfield, VA, 1975
B.S., Applied Sciences and Engineering, U.S. Military Academy, 1979
M.S., Mechanical and Aerospace Engineering, University of Virginia, 1989
CURRENT POSITION: Landing and Rollout Support Engineer
NASA Johnson Space Center, Houston, TX
PARENTS: Redmond V. and Patsy L. Forrester, Ft. Walton Beach, FL
MARITAL STATUS: Married to the former Diana L. Morris

NAME: Stephen N. Frick, Lieutenant Commander, USN, Pilot
BIRTHDATE/PLACE: September 30, 1964 - Pittsburgh, PA
RESIDENCE: California, MD
EDUCATION: Richland High School, Gibsonia, PA, 1982
B.S., Aerospace Engineering, U.S. Naval Academy, 1986
M.S., Aeronautical Engineering, U.S. Naval Postgraduate School, 1994
CURRENT POSITION: F/A-18 Ship Suitability Project Officer
Strike Aircraft Test Squadron, Naval Air Station, Patuxent River, MD
PARENTS: Neil H. and Charlotte S. Frick, Gibsonia, PA
MARITAL STATUS: Unmarried

NAME: John B. Herrington, Lieutenant Commander, USN, Mission Specialist
BIRTHDATE/PLACE: September 14, 1958 - Wetumka, OK
RESIDENCE: Leonardtown, MD
EDUCATION: Plano High School, Plano, TX, 1976
B.S., Applied Mathematics, University of Colorado at Colorado Springs, 1983
M.S., Aeronautical Engineering, U.S. Naval Postgraduate School, 1995
CURRENT POSITION: Special Projects Officer
BUPERS Sea Duty Component, Arlington, VA
PARENTS: James E. and Joyce D. Herrington, Spicewood, TX
MARITAL STATUS: Married to the former Debra A. Farmer

NAME: Joan E. Higginbotham, Mission Specialist
BIRTHDATE/PLACE: August 3, 1964 - Chicago, IL
RESIDENCE: Titusville, FL
EDUCATION: Whitney M. Young Magnet High School, Chicago, IL, 1982
B.S., Electrical Engineering, Southern Illinois University at Carbondale, 1987
M.S., Management, Florida Institute of Technology, 1992
M.S., Space Systems, Florida Institute of Technology, 1996 (expected August 1996)
CURRENT POSITION: Lead Orbiter Project Engineer
NASA Kennedy Space Center, Kennedy Space Center, FL
PARENTS: William and Inez Higginbotham, Chicago, IL
MARITAL STATUS: Unmarried

NAME: Charles O. Hobaugh, Captain, USMC, Pilot
BIRTHDATE/PLACE: November 5, 1961 - Bar Harbor, ME
RESIDENCE: Lexington Park, MD
EDUCATION: N. Ridgeville High School, N. Ridgeville, OH, 1980
B.S., Aerospace Engineering, U.S. Naval Academy, 1984
CURRENT POSITION: Instructor
U.S. Naval Test Pilot School, Naval Air Station, Patuxent River, MD
PARENTS: Jimmie H. and Virginia M. Hobaugh, Sault Ste Marie, MI
MARITAL STATUS: Married to the former Corinna L. Leaman

NAME: James M. Kelly, Captain, USAF, Pilot
BIRTHDATE/PLACE: May 14, 1964 - Burlington, IA
RESIDENCE: Las Vegas, NV
EDUCATION: Burlington Community High School, Burlington, IA, 1982
B.S., Astronautical Engineering, U.S. Air Force Academy, 1986
CURRENT POSITION: Assistant Operations Officer
Air Force Flight Test Center, Las Vegas, NV
PARENTS: William J. and Mary Ann Kelly, Burlington, IA
MARITAL STATUS: Married to the former Dawn R. Timmerman

NAME: Mark E. Kelly, Lieutenant, USN, Pilot
BIRTHDATE/PLACE: February 21, 1964 - Orange, NJ
RESIDENCE: Lexington Park, MD
EDUCATION: Mountain High School, West Orange, NJ, 1982
B.S., Marine Engineering and Nautical Science, U.S. Merchant Marine Academy, 1986
M.S., Aeronautical Engineering, U.S. Naval Postgraduate School, 1994
CURRENT POSITION: Instructor Pilot
U.S. Naval Test Pilot School
Naval Air Station, Patuxent River, MD
PARENTS: Richard and Patricia Kelly, Flagler Beach, FL
MARITAL STATUS: Married to the former Amelia V. Babis

NAME: Scott J. Kelly, Lieutenant, USN, Pilot
BIRTHDATE/PLACE: February 21, 1964 - Orange, NJ
RESIDENCE: Lexington Park, MD
EDUCATION: Mountain High School, West Orange, NJ, 1982
B.E., Electrical Engineering, State University of New York Maritime College, 1987
CURRENT POSITION: Test Pilot
Strike Aircraft Test Squadron, Naval Air Station
Patuxent River, MD
PARENTS: Richard and Patricia Kelly, Flagler Beach, FL
MARITAL STATUS: Married to the former Leslie S. Yandell

NAME: Paul S. Lockhart, Major, USAF, Pilot
BIRTHDATE/PLACE: April 28, 1956 - Amarillo, TX
RESIDENCE: Niceville, FL
EDUCATION: Tascosa High School, Amarillo, TX, 1974
B.A., Mathematics, Texas Tech University, 1978
M.S., Aerospace Engineering, University of Texas, 1981
CURRENT POSITION: Operations Officer
39th Flight Test Squadron, Eglin AFB, FL
PARENTS: The late Charles W. Lockhart
Leo and Joy L. Wiley, Amarillo, TX
MARITAL STATUS: Married to the former Mary T. Germaine

-more-

NAME: Christopher J. Loria, Major, USMC, Pilot
BIRTHDATE/PLACE: July 9, 1960 - Newton, MA
RESIDENCE: NAS Patuxent River, MD
EDUCATION: Belmont High School, Belmont, MA, 1978
B.S., General Engineering, U.S. Naval Academy, 1983
CURRENT POSITION: Test Pilot/Project Officer
Strike Aircraft Test Squadron
Naval Air Station, Patuxent River, MD
PARENTS: The late Robert L. Loria
Joan Loria, Belmont, MA
MARITAL STATUS: Married to the former Sandra L. Sullivan

NAME: Sandra H. Magnus, Ph.D., Mission Specialist
BIRTHDATE/PLACE: October 30, 1964 - Belleville, IL
RESIDENCE: Smyrna, GA
EDUCATION: Belleville West High School, Belleville, IL, 1982
B.S., Physics, University of Missouri-Rolla, 1986
M.S., Electrical Engineering, University of Missouri-Rolla, 1990
Ph.D., Materials Science and Engineering, Georgia Institute of Technology, 1996
CURRENT POSITION: Research Scientist
Georgia Institute of Technology
Material Science and Engineering Department, Atlanta, GA
PARENTS: Richard L. and Rose M. Hall, Belleville, IL
MARITAL STATUS: Married to Robert T. Magnus

NAME: Michael J. Massimino, Ph.D., Mission Specialist
BIRTHDATE/PLACE: August 19, 1962 - Oceanside, NY
RESIDENCE: Dunwoody, GA
EDUCATION: H. Frank Carey High School, Franklin Square, NY, 1980
B.S., Industrial Engineering, Columbia University, 1984
M.S., Mechanical Engineering and Technology and Policy, Massachusetts Institute of Technology, 1988
Degree of Mechanical Engineer, Massachusetts Institute of Technology, 1990
Ph.D., Mechanical Engineering, Massachusetts Institute of Technology, 1992
CURRENT POSITION: Assistant Professor
Georgia Institute of Technology
School of Industrial and Systems Engineering, Atlanta, GA
PARENTS: C. Mario and Vincenza Massimino, Franklin Square, NY
MARITAL STATUS: Married to the former Carola P. Pardo

NAME: Richard A. Mastracchio, Mission Specialist
BIRTHDATE/PLACE: February 11, 1960 - Waterbury, CT
RESIDENCE: Houston, TX
EDUCATION: Crosby High School, Waterbury, CT, 1978
B.S., Electrical Engineering and Computer Science, University of Connecticut, 1982
M.S., Electrical Engineering, Rensselaer Polytechnic Institute, 1987
M.S., Physical Sciences, University of Houston-Clear Lake, 1991
CURRENT POSITION: Guidance and Procedures Officer
NASA Johnson Space Center, Houston, TX
PARENTS: Ralph M. and Georgiana Mastracchio, Waterbury, CT
MARITAL STATUS: Married to the former Candace L. Stolfi

NAME: William C. McCool, Lieutenant Commander, USN, Pilot
BIRTHDATE/PLACE: September 23, 1961 - San Diego, CA
RESIDENCE: Anacortes, WA
EDUCATION: Coronado High School, Lubbock, TX, 1979
B.S., Applied Science, U.S. Naval Academy, 1983
M.S., Computer Science, University of Maryland, 1985
M.S., Aeronautical Engineering, U.S. Naval Postgraduate School, 1992
CURRENT POSITION: Operations Officer/Pilot
VAQ-132, Naval Air Station, Whidbey Island, WA
PARENTS: Barent N. and Audrey C. McCool, Las Vegas, NV
MARITAL STATUS: Married to the former Lani R. Vallejos

NAME: Lee M. Morin, Commander, USN, Mission Specialist
BIRTHDATE/PLACE: September 9, 1952 - Manchester, NH
RESIDENCE: Pensacola, FL
EDUCATION: Western Reserve Academy, Hudson, OH, 1970
B.S., Mathematics/Electrical Science, University of New Hampshire, 1974
M.S., Biochemistry, New York University, 1978
M.D., New York University, 1981
Ph.D., Microbiology, New York University, 1982
M.P.H., University of Alabama at Birmingham, 1988
CURRENT POSITION: Aerospace Medicine Resident
Naval Aerospace and Operational Medical Institute
Pensacola, FL
PARENTS: Laurent E. and Ann M. Morin, Silver Spring, MD
MARITAL STATUS: Married to the former Rosanne Spaccarelli

NAME: Lisa M. Nowak, Lieutenant Commander, USN, Mission Specialist
BIRTHDATE/PLACE: May 10, 1963 - Washington, DC
RESIDENCE: Lexington Park, MD
EDUCATION: C. W. Woodward High School, Rockville, MD, 1981
B.S., Aerospace Engineering, U.S. Naval Academy, 1985
M.S., Aeronautical Engineering, U.S. Naval Postgraduate School, 1992
Degree of Aeronautical and Astronautical Engineer, U.S. Naval Postgraduate School, 1992
CURRENT POSITION: F/A-18 Systems Engineer
Naval Air Systems Command, Arlington, VA
PARENTS: Alfred F. and Jane L. Caputo, Rockville, MD
MARITAL STATUS: Married to Richard T. Nowak

NAME: Donald R. Pettit, Ph.D., Mission Specialist
BIRTHDATE/PLACE: April 20, 1955 - Silverton, OR
RESIDENCE: Santa Fe, NM
EDUCATION: Silverton Union High School, Silverton, OR, 1973
B.S., Chemical Engineering, Oregon State University, 1978
Ph.D., Chemical Engineering, University of Arizona, 1983
CURRENT POSITION: Scientist
Los Alamos National Laboratory, Los Alamos, NM
PARENTS: Virgil E. Pettit, Silverton, OR
The late Ethyl R. Pettit
MARITAL STATUS: Married to the former Michelle R. Racheff

NAME: John L. Phillips, Ph.D., Mission Specialist
BIRTHDATE/PLACE: April 15, 1951 - Fort Belvoir, VA
RESIDENCE: Los Alamos, NM
EDUCATION: Scottsdale High School, Scottsdale, AZ, 1966
B.S., Mathematics and Russian, U.S. Naval Academy, 1972
M.S., Aeronautical Systems, University of West Florida, 1974
M.S., Geophysics and Space Physics, University of California-Los Angeles, 1984
Ph.D., Geophysics and Space Physics, University of California-Los Angeles, 1987
CURRENT POSITION: Space Plasma Physicist
Los Alamos National Laboratory, Los Alamos, NM
PARENTS: Carlton V. and Gladys M. Phillips, Scottsdale, AZ
MARITAL STATUS: Married to the former Laura J. Doell

NAME: Mark L. Polansky, Pilot
BIRTHDATE/PLACE: June 2, 1956 - Paterson, NJ
RESIDENCE: Houston, TX
EDUCATION: John P. Stevens High School, Edison, NJ, 1974
B.S., Aeronautical and Astronautical Engineering, Purdue University, 1978
M.S., Aeronautics and Astronautics, Purdue University, 1978
CURRENT POSITION: Research Pilot
NASA Johnson Space Center, Houston, TX
PARENTS: Irving and Edith Polansky, Edison, NJ
MARITAL STATUS: Unmarried

NAME: Paul W. Richards, Mission Specialist
BIRTHDATE/PLACE: May 20, 1964 - Scranton, PA
RESIDENCE: Annapolis, MD
EDUCATION: Dunmore High School, Dunmore, PA, 1982
B.S., Mechanical Engineering, Drexel University, 1987
M.S., Mechanical Engineering, University of Maryland, 1991
CURRENT POSITION: Mechanical Engineer
NASA Goddard Space Flight Center
Greenbelt, MD
PARENTS: The late James Richards
Angela Cordaro Richards, Dunmore, PA
MARITAL STATUS: Unmarried

NAME: Piers J. Sellers, Ph.D., Mission Specialist
BIRTHDATE/PLACE: April 11, 1955 - Crowborough, Sussex, United Kingdom
RESIDENCE: Greenbelt, MD
EDUCATION: Cranbrook School, Cranbrook, Kent, United Kingdom, 1973
B.S., Ecological Science, University of Edinburgh (Scotland), 1976
Ph.D., Biometeorology, Leeds University (United Kingdom), 1981
CURRENT POSITION: Research Scientist
NASA Goddard Space Flight Center, Greenbelt, MD
PARENTS: John A. Sellers, Church Crookham, United Kingdom
Hope Lindsay Sellers, Elstead, Surrey, United Kingdom
MARITAL STATUS: Married to the former Amanda H. Lomas

NAME: Heidemarie M. Stefanyshyn-Piper, Lt. Comdr. USN, Mission Specialist
BIRTHDATE/PLACE: February 7, 1963 - St. Paul, MN
RESIDENCE: Rockville, MD
EDUCATION: Derham Hall High School, St. Paul, MN, 1980
B.S., Mechanical Engineering, Massachusetts Institute of Technology, 1984
M.S., Mechanical Engineering, Massachusetts Institute of Technology, 1985
CURRENT POSITION: Underwater Ship Husbandry Project Officer
Naval Sea Systems Command, Arlington, VA
PARENTS: The late Michael Stefanyshyn
Adelheid Stefanyshyn, St. Paul, MN
MARITAL STATUS: Married to Glenn A. Piper III

NAME: Daniel M. Tani, Mission Specialist
BIRTHDATE/PLACE: February 1, 1961 - Ridley Park, PA
RESIDENCE: Centreville, VA
EDUCATION: Glenbard East High School, Lombard, IL, 1979
B.S., Mechanical Engineering, Massachusetts Institute of Technology, 1984
M.S., Mechanical Engineering, Massachusetts Institute of Technology, 1988
CURRENT POSITION: Manager-Pegasus Launch Operations
Orbital Sciences Corporation, Dulles, VA
PARENTS: The late Henry N. Tani
Rose S. Tani, Lombard, IL
MARITAL STATUS: Unmarried

NAME: Rex J. Walheim, Captain, USAF, Mission Specialist
BIRTHDATE/PLACE: October 10, 1962 - Redwood City, CA
RESIDENCE: Palmdale, CA
EDUCATION: San Carlos High School, San Carlos, CA, 1980
B.S., Mechanical Engineering, University of California-Berkeley, 1984
M.S., Industrial Engineering, University of Houston, 1989
CURRENT POSITION: Chief Engineer-Systems Branch
U.S. Air Force Test Pilot School, Edwards AFB, CA
PARENTS: Lawrence M. Walheim, Jr., Belmont, CA
The late Avis L. Walheim
MARITAL STATUS: Married to the former Margie D. Dotson

NAME: Peggy A. Whitson, Ph.D., Mission Specialist
BIRTHDATE/PLACE: February 9, 1960 - Mt. Ayr, IA
RESIDENCE: El Lago, TX
EDUCATION: Mt. Ayr Community High School, Mt. Ayr, IA, 1978
B.S., Biology/Chemistry, Iowa Wesleyan College, 1981
Ph.D., Biochemistry, Rice University, 1985
CURRENT POSITION: Deputy Chief-Medical Sciences Division
NASA Johnson Space Center, Houston, TX
PARENTS: E. Keith Whitson and Beth A. Walters-Whitson, Beaconsfield, IA
MARITAL STATUS: Married to Clarence F. Sams

NAME: Jeffrey N. Williams, Major, USA, Mission Specialist
BIRTHDATE/PLACE: January 18, 1958 - Superior, WI
RESIDENCE: Middletown, RI
EDUCATION: Winter High School, Winter, WI, 1976
B.S., Applied Sciences/Engineering, U.S. Military Academy, 1980
M.S., Aeronautical Engineering, U.S. Naval Postgraduate School, 1987
Degree of Aeronautical Engineer, U.S. Naval Postgraduate School, 1987
CURRENT POSITION: Student
Naval War College, Newport, RI
PARENTS: Lloyd D. and Eunice A. Williams, Winter, WI
MARITAL STATUS: Married to the former Anna-Marie Moore

NAME: Stephanie D. Wilson, Mission Specialist
BIRTHDATE/PLACE: September 27, 1966 - Boston, MA
RESIDENCE: Los Angeles, CA
EDUCATION: Taconic High School, Pittsfield, MA, 1984
B.S., Engineering Science, Harvard University, 1988
M.S., Aerospace Engineering, University of Texas, 1992
CURRENT POSITION: Attitude Control Engineer - Galileo
Jet Propulsion Laboratory, Pasadena, CA
PARENTS: Eugene and Barbara A. Wilson, Pittsfield, MA
MARITAL STATUS: Unmarried

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

May 1, 1996

Douglas Isbell
Headquarters, Washington, DC
(Phone: 202/358-1753)

Kristine Miller
Aurora Flight Sciences Corp., Manassas, VA
(Phone: 703/369-3633)

RELEASE: 96-85

ROBOTIC AIRCRAFT FOR EARTH SCIENCE SHIPPED FOR FIRST FLIGHT TEST

A prototype robotic aircraft called Theseus, with potentially unique abilities to support NASA's Mission to Planet Earth enterprise, has been shipped to California to be prepared for its first test flight.

Theseus was built for NASA under an innovative, $4.9 million fixed-price contract by Aurora Flight Sciences Corp., Fairmont, WV, and its partners at two West Virginia universities. The twin-engine, uncrewed vehicle has a 143-foot wingspan, and is constructed largely from composite materials. Powered by two 80-horsepower, turbocharged piston engines that drive twin 9-foot diameter propellers, Theseus is designed to fly autonomously at high altitudes, with take off and landing under the active control of a ground-based pilot viewing a video screen.

High-speed taxi testing of Theseus at NASA's Dryden Flight Research Center, Edwards, CA, is scheduled to begin in mid-May, with first flight by late June, according to Kevin Niewoehner, NASA Theseus project manager.

NASA's Office of Mission to Planet Earth is currently developing a long-term strategy for the use of robotic research aircraft. If the demonstration flight of Theseus is successful, it would become a candidate for participation in this effort.

Work on Theseus began formally in June 1994, less than two years ago. "Theseus represents a highly productive partnership between the government, the private sector, and the academic community, focused on rapid prototyping, tightly controlled budgets and cost-sharing," Niewoehner said.

-more-

With the potential ability to carry 700 pounds of science instruments to altitudes above 60,000 feet for durations of greater than 24 hours, Theseus is intended to support research in areas such as stratospheric ozone depletion and the atmospheric effects of future high-speed civil transport aircraft engines. Instruments carried aboard Theseus also would be able to validate satellite-based global environmental change measurements made by NASA's planned Earth Observing System.

In addition to these scientific missions, Theseus-derived vehicles are expected to have applications in commercial remote sensing and as telecommunications relay platforms, according to John Langford, president of Aurora Flight Sciences. "We can envision a small fleet of vehicles based on Theseus, with flexible payloads and flight times," Langford said.

Aurora Flight Sciences' partners in the development of Theseus include West Virginia University, Morgantown, WV, and Fairmont State College, Fairmont, WV.

EDITOR'S NOTE: An image to accompany this release is available to media representatives by calling the Imaging Branch on 202/358-1900. Photo numbers are:

Color	B&W
96-HC-49	96-H-49

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Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

May 2, 1996

Deanna Corridon
Headquarters, Washington, DC
(Phone: 202/358-1733)

VIDEO ADVISORY: V96-49

SOHO REVEALS STARTLING DATA ON THE SUN ON NTV THURSDAY

On Thursday NASA TV will televise footage and still images of the Sun taken from ultraviolet data gathered by the Extreme-ultraviolet Imaging Telescope on board the Solar and Heliospheric Observatory (SOHO) spacecraft. SOHO was designed to study the Sun's interior structure, corona, and the origin of solar wind blowing through the solar system. Latest findings have divulged unexpected activity during the Sun's apparent quiet period. Replaying on NTV will be footage of the Theseus robotic prototype aircraft, and a series of Saturn images captured by the Hubble Space Telescope.

ITEM #1: A NEW LOOK AT THE SUN
Video shows gases in the Sun's corona.

ITEM #2: SOLAR PLUMES
Erupting gas on the Sun forms plumes.

ITEM #3: THE UNQUIET SUN
Gases erupt from the Sun.

ITEM #4: THE ACTIVE SUN
Sequence of images shows continuous activity in Sun's polar region.

ITEM #5: SOURCES OF SOLAR WIND
Hot gas in the Sun's atmosphere may be one of the sources of solar "wind."

ITEM #6: A HOT NEW LOOK
Image shows 1.5 million degree Celsius gas in the Sun's corona.

ITEM #7: THE UNQUIET SUN (STILL)
Sequence of timed images taken by SOHO revealing the eruption of gas on the Sun.

ITEM #8: INTERVIEW - CRAIG DEFOREST, SOHO SCIENCE TEAM
Discusses the SOHO spacecraft and the results of the project.

ITEM #9: REPLAY - THESEUS, ROBOTIC AIRCRAFT
ITEM #10: REPLAY - INTERVIEW - MATT HUTCHISON
ITEM #11: REPLAY - INTERVIEW - JOHN LANGFORD
ITEM #12: REPLAY - SUNSET ON SATURN'S RING
ITEM #13: REPLAY - MOONS AROUND SATURN

Video news files air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

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News Release

National Aeronautics and
Space Administration

Washington, DC 20546
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For Release

Jim Cast
Headquarters, Washington, DC
(Phone: 202/358-1779)

May 2, 1996

Jim Doyle
Jet Propulsion Laboratory, Pasadena, CA
(Phone: 818/354-0474)

NOTE TO EDITORS: N96-29

JPL TO DISPLAY MICRO-INSTRUMENT TECHNOLOGY AT NASA HQ

During the week of May 6, the Jet Propulsion Laboratory's Center for Microelectronics Technology will display cutting-edge technologies in the West Lobby of the NASA Headquarters Building at 4th and E Streets, SW, in Washington, DC.

The display will feature working prototypes of miniature sensors, electronics and computing technologies for space missions. Many of these technologies have commercial as well as space applications and are being developed in partnership with U.S. industries.

A few among the many items to be displayed will include a working prototype miniature camera for medical, desktop computer conferencing and video phone applications (in partnership with AT&T and others); a working prototype long wavelength infrared video-rate camera (in partnership with Amber, a Raytheon company); a micro weather station and micro-seismometers for Mars and Earth science missions; a sub-millimeter technology for Earth science and astronomy; advanced flight computers (in partnership with TRW); and advanced concepts and design techniques for miniature science missions.

JPL personnel will be on hand May 6-10 to answer questions and discuss the technologies on display. No badging will be required, and reporters may view the displays anytime during normal business hours.

- end -

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Don Savage
Headquarters, Washington, DC
(Phone: 202/358-1727)

May 7, 1996

Mary Beth Murrill
Jet Propulsion Laboratory, Pasadena, CA
(Phone: 818/354-5011)

RELEASE: 96-86

NASA TO JOIN IN USE OF KECK TELESCOPES

NASA researchers are preparing to use the giant twin telescopes of the W.M. Keck Observatory together as a single, high-powered instrument in coming years to search for planets and planetary systems around nearby stars.

The recently completed Keck II Telescope, the second of the ten-meter (33-foot) diameter telescopes atop Hawaii's Mauna Kea, will be formally dedicated in ceremonies at the observatory on Wednesday, May 8.

Using the Keck telescopes in interferometric studies, wherein the two telescopes will make concurrent observations of the same object in space, will provide a dramatic increase in light-gathering and resolution over a single telescope. These studies will lay much of the groundwork for NASA's Origins Program, one goal of which is to seek planets around nearby stars.

"We're excited about the capability to combine the world's two largest telescopes into one very large 'light bucket,'" said Dr. Wesley Huntress, NASA's Associate Administrator for Space Science. "It will enable us to test this technique on the ground, and learn how to operate such systems, before we build a large interferometer in space to search for Earth-like planets."

"We now know that there are Jupiter-like planets around some other stars," said Dr. Edward C. Stone, Vice President of the California Institute of Technology, Director of NASA's Jet Propulsion Laboratory, Pasadena, CA, and Chairman of the Board of the California Association for Research in Astronomy (CARA). CARA, a partnership of the Caltech and the University of California, constructed and manages the observatory.

- more -

"One of the objectives of the Keck telescopes is to detect even more planets around nearby stars. We'll be looking primarily for Jupiter-like planets because Jupiters are so much easier to detect than much smaller Earth-like planets. But if there's a Jupiter-like planet around a given star, that would be a prime place to look with more sensitive space-based instruments for Earth-like planets."

The Keck II Telescope, like its twin Keck I, uses a mirror composed of 36 hexagonal pieces of glass, individually polished and assembled to form a huge, perfectly parabolic reflecting surface. This segmented mirror is much thinner, and therefore lighter in weight, than a solid mirror could be, which is the key to building such a large instrument.

Keck II also will have an adaptive optics facility, a method of compensating for the slight distortions caused by atmospheric turbulence. People see distorted starlight as twinkling, but for a telescope making a long exposure, the star looks slightly blurry. The adaptive optics system will be able to detect these tiny distortions and make one hundred tiny adjustments per second to the mirror to compensate for them and maintain the sharpest possible image.

In addition to doubling the amount of observing time available at the Keck Observatory, Keck II will allow a wider array of observing instruments to be used. Scientists have designed and built three specialized spectrographs -- instruments for recording an object's spectrum -- for use on Keck II that will make possible an observational program with great flexibility and range.

The W. M. Keck Foundation provided more than $150 million toward funding the telescopes. NASA has committed to provide $7 million a year for a total of $44 million for construction and $2 million a year for operating costs as part of a cooperative effort to develop and use infrared and optical interferometry. NASA's Jet Propulsion Laboratory, Pasadena, CA, manages the agency's participation in the W.M. Keck Observatory for NASA's Office of Space Science, Washington, DC.

- end -

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News Release

National Aeronautics and
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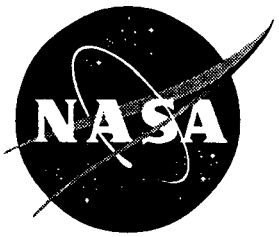

For Release

Don Savage
Headquarters, Washington, DC
(Phone: 202/358-1547)

May 2, 1996
Embargoed until 1 p.m. EDT

Jim Sahli
Goddard Space Flight Center, Greenbelt, MD
(Phone: 301/286-0697)

RELEASE: 96-87

UNEXPECTEDLY ACTIVE SUN AND NEW INSIGHTS INTO SOLAR PLUMES FOUND

Initial observations by the recently launched Solar and Heliospheric Observatory (SOHO) spacecraft reveal unexpected activity on the Sun and the best views yet of the sources of strange, chaotic "plume" structures that extend from the solar poles to high altitudes within its outer atmosphere, or corona.

SOHO was specifically designed to observe the Sun during a supposedly "quiet" period near the bottom of its 11-year sunspot cycle, when solar disturbances are at a minimum and the undisturbed solar atmosphere and interior could best be studied.

To the surprise and excitement of SOHO's scientific investigators, "movies made from SOHO ultraviolet data show that there is continuous motion and action everywhere on the Sun," said Dr. Joseph Gurman of NASA's Goddard Space Flight Center, Greenbelt, MD.

Disturbances are occurring even within so-called "coronal holes," areas of particularly low density, low temperature and open magnetic field lines in the corona, where such disturbances were least expected. An open magnetic field is one in which the lines of magnetic force stretch out indefinitely into interplanetary space, rather than looping back downward onto the Sun.

The dramatic new ultraviolet movies from SOHO also have revealed the source areas of the long, feathery plumes that extend from regions near the poles of the Sun to more than 13 million miles into interplanetary space. The sequences of ultraviolet images, combined into movies by SOHO researchers, show the polar plumes standing in the solar wind, an outward streaming of electrified gas from the corona. The movies clearly reveal the bases of the plumes, never characterized before, to be seething regions of wildly gyrating magnetic fields and turbulent solar gases.

-more-

"Polar plumes are a natural laboratory to explore two of the main objectives of the SOHO mission," explained Dr. Craig DeForest of Stanford University, Palo Alto, CA. These goals are to learn how the Sun's corona is heated to about 3.6 million degrees Fahrenheit and why the solar wind in some places reaches speeds of almost two million miles per hour. The plume data may even shed light on the third main goal of SOHO, to determine what occurs below the solar surface to generate the strong flows and intense magnetism that produce solar disturbances such as sunspots and solar flare explosions.

The chaotic conditions discovered by SOHO at the base of the polar plumes also are under analysis. Early data show that often the base of a plume is a bright point in the solar atmosphere, as seen in ultraviolet light. These bright points fluctuate rapidly in intensity and are at locations where magnetic fields are rapidly changing. "These magnetic changes may represent the release of significant amounts of energy on the Sun, and they contribute to the heating of the corona," said Gurman.

A chief aim of the SOHO polar plume research is to see if plumes can be positively identified as the sources of high-speed streams of solar wind that were directly sampled by the European Space Agency's Ulysses spacecraft when it passed over the poles of the Sun in 1994 and 1995. In earlier work with sounding rocket experiments, DeForest concluded that the plumes may contain high-speed outward gas flows. "Now, we are trying to determine whether the plumes are in fact the fundamental source of the high speed streams," he said.

The dramatic changes found at the foot of the polar plumes "appear to include the breaking open of small magnetic arches to form 'jets' that expel mass at coronal temperatures," Gurman added. Such jets have been observed in the X-ray portion of the spectrum by a telescope on Japan's Yohkoh spacecraft, "but this is the first time that small-scale jets have been observed outside large active regions on the Sun," he said. "In fact, we are seeing them in a coronal hole at the south pole, along with the plumes."

Much of the new information on polar plumes and on the unexpected disturbances on the "quiet Sun" comes from the SOHO Extreme-ultraviolet Imaging Telescope (EIT). Dr. Jean-Pierre Delaboudiniere, of the Institut d'Astrophysique Spatiale, Orsay, France, is principal investigator for EIT. The EIT images show the portion of the plumes from their bases in the solar surface layer out to heights of about 93,000 miles. At its base, a plume is about 1.5 times as wide as the diameter of the Earth--which is 7,928 miles.

Other important information comes from SOHO's Michelson Doppler Imager (MDI), which measures underlying magnetic fields and gas flow patterns on the solar surface, and from the Large-Angle Spectroscopic Coronagraph (LASCO), which images the plumes as far as 30 solar radii from the surface of the Sun. (The radius of the Sun is about 440,000 miles.) Professor Philip Scherrer of Stanford University is the principal investigator for MDI and Dr. Guenther Brueckner of the Naval Research Laboratory, Washington, DC, is the principal investigator for LASCO.

SOHO is on location in space near the L-1 Lagrangian point, where the Earth's and Sun's gravitational forces balance, some one million miles sunward from the Earth. This vantage point enables solar astronomers to observe the Sun continuously, with no intervening "night."

SOHO is a project of international cooperation between NASA and the European Space Agency. It was launched on Dec. 2, 1995 from the Cape Canaveral Air Force Station, FL. The Extreme-ultraviolet Imaging Telescope is the product of laboratories in France, Belgium, and the U.S. The Large-Angle Spectroscopic Coronagraph was fabricated at laboratories in the U.S., Germany, France, and the United Kingdom. The Michelson-Doppler Imager was produced at laboratories in the United States.

-end-

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Deanna Corridon
Headquarters, Washington, DC
(Phone: 202/358-1733)

May 3, 1996

VIDEO ADVISORY: V96-50

JUPITER'S "IRON IO" AND THE 35TH ANNIVERSARY OF PROJECT MERCURY ON NTV FRIDAY

On NASA TV Friday NASA's Galileo spacecraft divulges information on Jupiter's moon Io. Scientists studying data from Galileo now believe the moon has an iron core and may possess its own magnetic field, which would make the moon the first of its kind to have one. NTV also will transmit footage commemorating the 35th Anniversary of Project Mercury. On May 5, 1961, Alan Shepard made his historic flight aboard the Mercury capsule Freedom 7 marking the first United States manned suborbital flight. Replaying on NTV will be SOHO footage and still images of the Sun taken from ultraviolet data gathered by the Extreme-ultraviolet Imaging Telescope on board the Solar and Heliospheric Observatory (SOHO) spacecraft.

ITEM #1: GALILEO FINDS IO'S IRON CORE
Galileo reveals new data about Jupiter's volcano-pocked moon Io.

ITEM #2: IO'S IRON CORE
Animation shows a cutaway of Io revealing its core.

ITEM #3: SURFACE MAP OF IO
Animation displays a surface gravity map on a rotating Io.

ITEM #4: INTERVIEW - DR. TORRENCE JOHNSON, GALILEO PROJECT SCIENTIST
Discusses Galileo flyby of Io.

ITEM #5: INTERVIEW - DR. JOHN ANDERSON, GALILEO TEAM LEADER
Description of how data from Galileo has revealed new information about Io's inner core.

ITEM #6: INTERVIEW - DR. MARGARET KIVELSON, GALILEO MAGNETOMETER INVESTIGATOR
Description of how data from Galileo has revealed new information about Jupiter and Io's magnetic field.

ITEM #7: MERCURY 35TH ANNIVERSARY
Alan Shepard's historic U.S. first manned suborbital flight.

ITEM #8: REPLAY - A NEW LOOK AT THE SUN
ITEM #9: REPLAY - SOLAR PLUMES
ITEM #10: REPLAY - THE UNQUIET SUN
ITEM #11: REPLAY - THE ACTIVE SUN
ITEM #12: REPLAY - SOURCES OF SOLAR WIND
ITEM #13: REPLAY - A HOT NEW LOOK
ITEM #14: REPLAY - THE UNQUIET SUN (STILL)
ITEM #15: REPLAY - INTERVIEW - CRAIG DEFOREST, SOHO SCIENCE TEAM

Video news files air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

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News Release

National Aeronautics and
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Washington, DC 20546
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For Release

May 3, 1996

Dwayne Brown
Headquarters, Washington, DC
(Phone: 202/358-1600)

RELEASE: 96-88

FORCE TO LEAVE NASA

Charles T. Force, Associate Administrator for NASA's Office of Space Communications, announced that he is leaving NASA, effective May 6, to pursue commercial business interests.

"It has been an honor and privilege to work with the dedicated men and women at NASA. I am especially proud of the achievements of the people in the Space Communications program. The increasingly ambitious achievements of NASA programs would not have been possible without corresponding increases in telecommunications capabilities. The Space Communications staff not only succeeded in satisfying these challenging needs, but also reduced operating costs by a third over the past five years," Force said.

Force was named Associate Administrator for Space Operations in July 1989. He joined NASA in 1965 as Director of the Guam tracking station and except for returning to industry for a couple of years in the early 1980's, held increasingly responsible positions at NASA since that time.

Force received several awards and honors for his work. He was instrumental in the development, construction and the eventual "fully operational" declaration of the Tracking and Data Relay Satellite System (TDRSS). TDRSS replaced a nearly 25-year-old, worldwide ground-based communications network. The revolutionary system cut NASA's telecommunications costs in half, yet increased data acquisition and communications contact time with spacecraft six-fold. This February, the TDRSS achieved 100 percent error-free coverage with its satellites and ground station command centers.

-end-

News Release

National Aeronautics and
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Washington, DC 20546
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For Release

Douglas Isbell
Headquarters, Washington, DC
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Mary Beth Murrill
Jet Propulsion Laboratory, Pasadena, CA
(Phone: 818/354-5011)

May 3, 1996

RELEASE: 96-89

GALILEO FINDS GIANT IRON CORE IN JUPITER'S MOON IO

Jupiter's volcano-pocked moon Io has been found by NASA's Galileo spacecraft to have a giant iron core that takes up half its diameter, scientists report in today's issue of Science magazine.

The spacecraft also has detected a large "hole" in Jupiter's magnetic field near Io, leading to speculation about whether Io possesses its own magnetic field. If so, it would be the first planetary moon known to have one.

These newly identified characteristics of Io may be related to the intense heating of the moon caused by the constant squeezing and distortion of Io in Jupiter's powerful gravitational grip, according to Galileo Project Scientist Dr. Torrence Johnson of NASA's Jet Propulsion Laboratory (JPL), Pasadena, CA. Io is the most geologically active body in the Solar System, and though it is less than a third of Earth's size, it generates twice as much heat as the Earth.

"Jupiter's massive gravity field distorts the shape of Io in the same way that tides are raised in Earth's oceans by the gravitational tugs of the Sun and Moon," Johnson said. As Io orbits Jupiter, these so-called "body tides" rise and fall due to subtle changes in Io's orbit which in turn are caused by the gravitational nudges from Europa and Ganymede, other moons of Jupiter.

As a result, Io is squeezed like a rubber ball. Friction created by this action heats and melts rock within Io to produce the volcanoes and lava flows seen all over its surface, and huge geysers that spew sulfur dioxide onto Io's landscape.

-more-

The large, dense core Galileo found within Io was deduced from data taken during the spacecraft's flyby within 559 miles of the moon last Dec. 7, as Galileo passed by the moon on its way to enter orbit around Jupiter. Precise measurements of the spacecraft's radio signal revealed small deviations in Galileo's trajectory caused by the effects of Io's own gravity field.

From these data, Galileo scientists have determined that Io has a two-layer structure. At the center is a metallic core, probably made of iron and iron sulfide, about 560 miles in radius, which is overlain by a mantle of partially molten rock and crust, according to JPL's Dr. John Anderson, team leader of Galileo's celestial mechanics experiment and principal author of the paper published in Science today. The core was probably formed from heating in the interior of the moon, either when it originally formed or as a result of the perpetual tidal heating driving its volcanoes.

Galileo scientists also are trying to determine the cause of the hole they found in Jupiter's magnetic field when the spacecraft was closest to Io. "Instead of increasing continuously as the spacecraft neared Jupiter, the magnetic field strength took a sudden drop of about 30 percent," Johnson said.

"It's an astonishing result and completely unexpected," said Dr. Margaret Kivelson of the University of California at Los Angeles, who heads Galileo's magnetic fields investigation team. Preliminary analyses of these data are currently being prepared for formal publication.

"The data suggest that something around Io -- possibly a magnetic field generated by Io itself -- is creating a bubble or hole in Jupiter's own powerful magnetic field," Kivelson said. "But it's not clear to us just how Io can dig such a deep and wide magnetic hole."

Possible explanations for this signature can only be sorted out using data from all the other space physics instruments onboard Galileo, Johnson said. "We're eagerly awaiting the return of data from the magnetospheric measurements taken during the Io flyby to see if we can resolve this mystery," he said. This data, recorded on board the spacecraft, will be transmitted back to Earth in June or July.

If analysis of this data eventually proves that Io indeed has a magnetic field of its own, it would be the first moon shown to have one. Io would join the Earth, planet Mercury and the outer giant planets as bodies in our Solar System that generate their own magnetic fields.

Other studies conducted by Galileo during its December flyby of Io have provided new evidence that Io is most likely the source of high-velocity dust streams littering millions of miles of space around Jupiter.

-more-

In July 1994, Galileo's dust detector began sensing dust streams more powerful than those previously discovered by the Ulysses spacecraft. Dust detectors on Galileo sensed more and more particles during its approach to Jupiter, reaching a peak of 20,000 impacts per day during the longest and most intense interplanetary dust storm ever observed.

These fast-moving particles travel at speeds from 30 to 60 miles per second away from Jupiter -- fast enough to escape the Solar System. These dust impacts continued up to the time of Galileo's Io flyby and then ceased, said Dr. Eberhard Grun of Germany's Max Planck Institute in Heidelberg, principle investigator for Galileo's dust detector experiment.

"My preliminary interpretation of these observations is that they support the idea that Io is in some way the source of the Jupiter dust streams," Grun said.

One theory proposed after the NASA Voyager spacecraft flybys in the late 1970s is that dust particles emitted from Io's volcanoes could become electrically charged and then swept away by Jupiter's rotating magnetic field. Recent modifications to this theory suggest that the dust is subsequently accelerated in the magnetosphere and flung outward from Jupiter at high velocity, creating dust streams.

Galileo's next close encounter with a moon of Jupiter will occur June 27, when the spacecraft will pass about 530 miles above the surface of Ganymede. Larger than Mercury, Ganymede is the largest moon in the Solar System. Galileo will make repeated close flybys of Ganymede, Callisto and Europa during its two-year mission in orbit around Jupiter.

Galileo was launched aboard Space Shuttle Atlantis on Oct. 18, 1989. The mission is managed by JPL for the NASA Office of Space Science, Washington, DC.

Additional information on the Galileo mission and its results can be found on the World Wide Web at URL:

http://www.jpl.nasa.gov/galileo/

- end -

To obtain a copy of the Science magazine article (Dr. John Anderson et al) reporting the new findings on Io's core, contact the AAAS Office of Communications, 202/326-6421.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

Beth Schmid
Headquarters, Washington, DC
(Phone: 202/358-1760)

For Release

May 3, 1996

RELEASE: 96-90

NASA SSIP WINNERS HONORED IN WASHINGTON, DC

Twenty-seven students from public and private schools across the United States have won national recognition in NASA's 16th annual Space Science Student Involvement Program (SSIP) competition. The students will be honored along with their teachers at the National Space Symposium, May 4-8, at the Marriott Hotel at Metro Center, 775 12th St., N.W., Washington, DC.

The competition, co-sponsored by NASA and the National Science Teachers Association, is an interdisciplinary program designed to address the need for greater literacy in the areas of science, critical and creative thinking, mathematics and technology. Over 10,000 students in elementary, junior high, and high school competed in five competition categories using their skills in mathematics, science, technology, art and creative writing.

The National Space Science Symposium brings together the 27 national SSIP winners and their teachers to recognize their academic achievement in an environment designed to further challenge their talents. The trip to the symposium includes formal presentations by the students of their entries.

In addition to their recognition in Washington, the students will have the opportunity to intern at a NASA field center for a week during the summer and will receive a Space Camp scholarship.

On Monday, May 6, at 1:30 p.m., eight national high school student winners will present proposals for a Mars Science Experiment Project to a panel of scientists.

At 6:30 p.m. on Tuesday, May 7, the students and their teachers will be honored at a banquet at the Marriott Hotel at Metro Center. The banquet speaker will be Dr. Ronald Parise, a former astronaut who is currently a member of the research team analyzing ultraviolet images returned from the STS-67/Astro-2 Space Shuttle mission.

Names and categories of the student winners are available in the NASA Headquarters newsroom by calling 202/358-1760.

-end-

News Release

National Aeronautics and
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Washington, DC 20546
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For Release

Don Savage
Headquarters, Washington, DC
(Phone: 202/358-1547)

May 6, 1996

Tammy Jones
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(Phone: 301/286-5566)

Ray Villard
Space Telescope Science Institute, Baltimore, MD
(Phone: 410/338-4514)

NOTE TO EDITORS: N96-30

PROGRESS ON MEASURING THE UNIVERSE SUBJECT OF MAY 9 UPDATE

The next Space Science Update (SSU), scheduled for Thursday, May 9, at 1 p.m. EDT, will feature the latest results from two independent teams of astronomers measuring the rate of expansion of the universe -- the key to uncovering both the age and eventual fate of the universe. The teams, now at about the halfway point in their respective studies, will report major progress in converging on an accurate measurement. The panelists also will discuss where their findings are still in conflict, as well as the difficult and often controversial questions arising from their research.

Panelists will be:

* Dr. Wendy Freedman, Carnegie Observatories, Pasadena CA,
* Dr. Abhijit Saha, Space Telescope Science Institute (STScI) , Baltimore
* Dr. David Spergel, Princeton University, NJ
* Dr. Anne L. Kinney, STScI
* Dr. Steve Maran, Goddard Space Flight Center, Greenbelt, MD is panel moderator

The SSU will originate from NASA Headquarters Auditorium, 300 E St., S.W., Washington, DC, and will be carried live on NASA TV with two-way question-and-answer capability for reporters covering the event from participating NASA centers.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz. Audio of the broadcast will be available on voice circuit at the Kennedy Space Center on 407/867-1260.

- end -

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

May 7, 1996

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George Diller
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(Phone: 407/867-2468)

NOTE TO EDITORS: N96-31

NASA SETS MAY 19 AS LAUNCH DATE FOR MISSION STS-77

At the conclusion of a flight readiness review meeting today, NASA managers set May 19, 1996 as the official launch date for the agency's next Space Shuttle mission, designated STS-77. The original target date of May 16 was not available on the Eastern Range schedule.

NASA's fourth Shuttle mission of 1996 will involve Shuttle Endeavour and a six-person crew performing microgravity research aboard the commercially owned and operated SPACEHAB Module. The crew also will deploy and retrieve a research satellite and perform rendezvous operations with a test satellite.

Launch of Endeavour on May 19 is scheduled for 6:30 a.m. EDT at the opening of a 2 1/2 hour available launch window. The STS-77 mission is forecast to last just over 10 days. Mission Control in Houston will be closely monitoring power consumption and cryogenic fuel reserves associated with the Shuttle's power system during the flight. Mission managers will have an option of shortening the mission one day if necessary. An on-time launch and nominal mission duration would result in a landing on May 29 a little after 7 a.m. EDT at Kennedy Space Center's Shuttle Landing Facility.

The STS-77 crew is commanded by John Casper, making his fourth Shuttle flight. The pilot for the mission, Curt Brown, is making his third flight. There are four mission specialists assigned to the flight. Andrew Thomas, serving as Mission Specialist-1, is making his first flight. Mission Specialist-2 is Dan Bursch who is making his third flight. Mario Runco, serving as Mission Specialist-3, also is making his third flight. Mission Specialist-4 is Canadian astronaut Marc Garneau, who is flying in space for the second time.

STS-77 will be the 11th flight of Endeavour and the 77th mission flown since the start of the Space Shuttle program in 1981.

-end-

Video Advisory

National Aeronautics and
Space Administration
Washington, DC 20546
(202) 358-1600

For Release

Debbie Rivera
Headquarters, Washington, DC
(Phone: 202/358-1743)

May 8, 1996

VIDEO ADVISORY: V96-52

DELTA CLIPPER -- READY FOR NASA TEST FLIGHT ON NTV THURSDAY

The Delta Clipper - Experimental Advanced (DC-XA), a single stage rocket developed by NASA and McDonnell Douglas Aerospace, completed a series of ground tests at the U.S. Army White Sands Missile Range in New Mexico on May 7. The DC-XA is being readied for a series of flight tests scheduled to begin May 17.

ITEM #1: DELTA CLIPPER TO RESUME FLIGHT
Includes engine firing on the pad at White Sands.

ITEM #2: INTERVIEW - CURTIS MCNEAL, DC-XA DEPUTY PROGRAM MANAGER
McNeal describes the DC-XA and its ground testing.

Video news files air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
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Washington, DC 20546
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For Release

May 8, 1996

RELEASE: 96-91

DOD/NASA COORDINATING BOARD FINDS WAYS TO AVOID COSTS

The Department of Defense and NASA are working together to share resources and save money.

The Aeronautics and Astronautics Coordinating Board (AACB), chaired by Under Secretary of Defense for Acquisition and Technology, Dr. Paul Kaminski, and NASA Acting Deputy Administrator General John Dailey, met recently to review the results of several months of work by both agencies. This initiative, begun in 1995, is intended to achieve significant reductions in investment and operations costs and to enhance mission effectiveness and cost efficiencies through increased cooperation among DOD and NASA activities at all organizational levels.

"These are not new savings but efficiencies we've found to take care of the budget cuts we have already been allocated," Dailey said. For example, by combining spacecraft technology demonstrations and sharing results from each other's experiments having similar objectives, officials have estimated a potential cost avoidance of $60 million. Additional examples of cost savings include:

At Edwards Air Force Base/Dryden Flight Research Center in Edwards, CA, a $14 million cost avoidance is being achieved through sharing a C-17 aircraft hangar, and another $60,000 a year can be saved by sharing the cryogenics systems facility there. Also at Edwards/Dryden, NASA will use the Air Force's aircraft paint facility, saving $128,000 a year, and the Air Force will use Dryden's tracking radar to save $370,000 a year. Another example of cooperation is the sharing of a day care facility for the families of Edwards/Dryden employees.

At Langley Air Force Base/Langley Research Center, Hampton, VA, a $445,000 cost avoidance will be achieved through joint use of an alternate fueling facility. At the Army's Redstone Arsenal/Marshall Space Flight Center, Huntsville, AL, a cost avoidance of $200,000 a year will be realized by the Army's use of Marshall's photo laboratory.

-more-

At Patrick Air Force Base/Kennedy Space Center, FL, cost avoidances will be achieved through NASA's use of the Air Force's medical supplies for its employee health facility. The AACB will continue to look for new areas where DOD and NASA can work together to save money, Dailey said.

Dr. Kaminski said, "We need to keep the emphasis on identifying additional savings in major facilities" and provided suggestions for additional work in this area in the future, to include the development of improved cost models on which to base decisions.

The AACB work was accomplished through joint DOD and NASA Integrated Product Teams in seven major areas: Technology and Laboratories, Major Facilities, Space Launch, Center/Base Support and Services, Satellite Telemetry, Tracking and Command, Personnel Exchange and Interagency Agreements. These teams developed recommendations covering a wide range of activities from specific technologies such as micro-electromechanical devices and fly-by-light systems to infrastructure improvements such as combined support contracts at field centers and exchange of scientists and engineers. Recommendations made for standardization of telemetry, tracking, and command and control have potential for significant cost avoidance and increased efficiency in the future.

Implementation of the recommendations will be monitored through the standing panels of the AACB. A report documenting the effort will be available in August.

-end-

News Release

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For Release
May 8, 1996

RELEASE: 96-92

WITH GROUND TESTS COMPLETE, DC-XA TO RESUME FLIGHTS THIS MONTH

The Delta Clipper-Experimental Advanced (DC-XA), a single stage rocket developed by NASA and McDonnell Douglas Aerospace, yesterday completed a series of ground tests at the U.S. Army White Sands Missile Range, New Mexico, and now is being readied for flight.

The DC-XA will undergo a series of five flight tests beginning no earlier than May 17. The date for the first test will be determined later this week.

"Flight testing the DC-XA will provide information about the performance of composite materials and other advanced technologies in the launch vehicle as it encounters the conditions of flight, such as temperature, pressure and noise. This information will be very valuable for the X-33 technology demonstrator NASA and an industry partner will develop in the future," said Dan Dumbacher, NASA's DC-XA program manager at the Marshall Space Flight Center, Huntsville, AL. Marshall is the host center for NASA's Reusable Launch Vehicle Technology Program. The U.S. Air Force's Phillips Laboratory at Kirtland Air Force Base, New Mexico, will manage flight test operations.

The DC-XA evolved from the DC-X, which the U.S. Air Force flew eight times between August 1993 and July 1995. The 43-foot-high existing airframe was extensively modified by replacing existing systems with a composite hydrogen tank; a Russian-built aluminum-lithium alloy liquid oxygen tank; a composite intertank to connect the hydrogen and oxygen tanks; and an auxiliary propulsion system which includes a composite liquid hydrogen feedline, a composite liquid hydrogen valve, a liquid-to-gas conversion system reaction control system, and a Russian auxiliary power unit providing redundant hydraulic power for flight control.

"When DC-XA lifts off from its launch stand, it will be the first time a rocket has flown with a composite hydrogen tank. This innovation and the many other technology enhancements included in the vehicle will make its flight testing very challenging," said Dumbacher.

-more-

Ground testing of the DC-XA exercised all of the vehicle subsystems and showed the vehicle is ready for flight, Dumbacher said. It included three firings of DC-XA's main propulsion system, between three and 20 seconds in duration, and up to 95 percent thrust level.

McDonnell Douglas is supported in the preparation of DC-XA for flight by Aerojet, prime developer of the auxiliary propulsion system; Lockheed Martin Corporation, developer of the ground propellant system, and by Rockwell International, which provided an acoustic structural health monitoring system for the hydrogen tank.

The DC-XA, X-34 and X-33, and related long term technology development efforts, comprise NASA's Reusable Launch Vehicle Technology Program, a partnership among NASA, the Air Force and private industry to develop a new generation of single-stage-to-orbit launch vehicles. The X-34, a small technology demonstrator, will undergo test flight in 1998 while the X-33 large technology demonstrator is planned for test flight in 1999. Success of the X-33 could lead to a national, industry-led decision to develop a commercial reusable launch vehicle early next century. Such a vehicle would dramatically reduce the cost of launching payloads into space.

NOTE TO REPORTERS/EDITORS:

A news media briefing on DC-XA will be broadcast on NASA TV at 2 p.m. EDT on Monday, May 13. The briefing will originate from Marshall Space Flight Center, Huntsville, AL. Participants will be Gary Payton, Reusable Launch Vehicle Technology Program director; Dan Dumbacher, NASA DC-XA program manager; Dave Schweikle, McDonnell Douglas DC-XA program manager; and Lt. Col. Jess Sponable, USAF, NASA deputy for Flight Test Operations.

Viewing of the planned May 17 flight test is not available to the general public. News media representatives may attend by pre-registering with the White Sands Missile Range Public Affairs Office; accreditation must be requested in writing. The mailing address is: Public Affairs Office, Building 122, White Sands Missile Range, NM, 88002. The office facsimile machine number is 505/678-7174.

All frequency transmissions are restricted within White Sands Missile Range. Anyone using any kind of equipment which transmits a signal (i.e. satellite equipment, microwave equipment, cellular telephones, wireless microphones, etc.) must have prior approval from the missile range's Department of Defense Area Frequency Coordinator, Tom Banks, at 505/678-1510. Requests must be submitted no later than May 14.

- end -

News Release

National Aeronautics and
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Washington, DC 20546
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For Release

May 8, 1996

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RELEASE: 96-93

NASA NAMES CHIEF VETERINARY OFFICER

Joseph T. Bielitzki, DVM, has been named chief veterinary officer for NASA. Bielitzki, of NASA's Ames Research Center, Mountain View, CA, recently was appointed to the newly created position by Dr. Harry C. Holloway, former Associate Administrator for Life and Microgravity Sciences and Applications.

"The complexities and frequent changes in national and international regulations and policies governing the care and use of animals demand the kind of expertise that Dr. Bielitzki brings to the Agency," said Dr. Arnauld Nicogossian, Acting Associate Administrator of Life and Microgravity Sciences and Applications. Nicogossian replaced Holloway, who recently left the Agency.

In his new assignment, Bielitzki is responsible for the oversight and coordination of animal care and veterinary activities at all NASA facilities. He also is responsible for ensuring NASA's compliance with all U.S. laws, regulations, guidelines and standards governing the care and use of research animals. He will remain located at Ames.

Bielitzki has more than 20 years' experience in veterinary care and medicine, including positions at the National Institutes of Health's Regional Primate Research Center at the University of Washington and at the Yerkes Primate Research Center at Emory University, Atlanta.

Nicogossian said creation of the new position reflects NASA's continuing commitment to ensuring the highest quality scientific research and the ethical use and care of research animals.

-end-

Video Advisory

National Aeronautics and
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Washington, DC 20546
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Debbie Rivera
Headquarters, Washington, DC
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For Release

May 9, 1996

VIDEO ADVISORY: V96-53

MOVING OF SATURN V, HUBBLE IMAGES FRIDAY

On Friday NASA TV will air video of a Saturn V rocket at the Kennedy Space Center, Florida, being moved to a new facility at the Center designed to highlight NASA's Apollo-era accomplishments. File footage of the Optical Transient Detector, a a spaceborne lightening detector, will be aired. Also airing Friday will be a replay of ground-based and Hubble Space Telescope images that are used to measure distances of faraway galaxies.

ITEM #1: THE SATURN V IS MOVING
Saturn V rocket at Kennedy Space Center is moved to new home.

ITEM #2: OPTICAL TRANSIENT DETECTOR
File footage of the Optical Transient Detector, an instrument designed to detect lightening from space..

ITEM #3: FARAWAY GALAXIES
Hubble scientists use bright stars to measure distances in millions of light years.

ITEM #4: DISTANCE TO THE GALAXIES
Hubble uses bright stars to measure vast distances in space.

Video news files air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
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Washington, DC 20546
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For Release

May 9, 1996

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RELEASE: 96-94

HUBBLE ON TRACK FOR MEASURING THE EXPANSION OF THE UNIVERSE

Two international teams of astronomers, using NASA's Hubble Space Telescope, are reporting major progress in converging on an accurate measurement of the Universe's rate of expansion -- a value which has been debated for over half a century.

These new results yield ranges for the age of the Universe from 9-12 billion years, and 11-14 billion years, respectively. The goal of the project is to measure the Hubble Constant to ten percent accuracy.

The Hubble Space Telescope Key Project team, an international group of over 20 astronomers, is led by Wendy Freedman of Carnegie Observatories, Pasadena, CA, Robert Kennicutt, University of Arizona, Tucson, AZ, and Jeremy Mould, Mount Stromlo and Siding Springs Observatory, Australia. The group's interim results, presented today at a meeting held at the Space Telescope Science Institute (STScI) in Baltimore, MD, are consistent with their preliminary result, announced in 1994, of 80 kilometers per second per megaparsec (km/sec/Mpc), based on observations of a galaxy in the Virgo cluster.

"We have five different ways of measuring the Hubble Constant with HST," said Dr. Freedman. "The results are coming in between 68 and 78 km/sec/Mpc". (For example, at an expansion rate of 75 km/sec/Mpc, galaxies appear to be receding from us at a rate of 162,000 miles per hour for every 3.26 million light years farther out we look).

- more -

Two months ago, a second team, led by Allan Sandage, also of the Carnegie Observatories, Abhijit Saha, STScI, Gustav Tammann and Lukas Labhardt, Astronomical Institute, University of Basel, Duccio Macchetto and Nino Panagia, STScI/European Space Agency, reported a slower expansion rate of 57 km/sec/Mpc.

The value of the Hubble Constant allows astronomers to calculate the expansion age of the Universe, the time elapsed since the Big Bang. Astronomers have been arguing recently whether the time since the Big Bang is consistent with the ages of the oldest stars.

The ages are calculated from combining the expansion rate with an estimate of how much matter is in space. The younger age values from each team assume the Universe is at a critical density where it contains just enough matter to expand indefinitely. The higher age estimates are calculated based on a low density of matter in space. (See "Science Background" for more information on the expanding Universe.)

"A point of great interest is whether the age of the Universe arrived at this way is really older than the independently derived ages of the oldest stars," said Saha, an investigator on both Hubble teams.

"The numbers lean on the side that the stellar ages are a little lower, or that the hypothesis that we live in a critical density universe needs to be questioned," said Saha. "As further results accumulate over the next few years, we hope to tighten the constraints on these issues."

THE OBSERVATIONS

The Key Project team is midway along in their three-year program to derive the expansion rate of the Universe based on precise distance measurements to galaxies. They have now measured Cepheid distances to a dozen galaxies, and are about halfway through their overall program.

The Key Project team also presented a preliminary estimate of the distance to the Fornax cluster of galaxies. The estimate was obtained through the detection and measurement with the Hubble Space Telescope of pulsating stars known as Cepheid variables found in the Fornax cluster. The Fornax cluster is measured to be approximately as far away as the Virgo cluster of galaxies -- about 60 million light-years.

The Key Project team member who led this effort, Caltech astronomer Barry Madore said, "This cluster allows us to make independent estimates of the expansion rate of the Universe using a number of different techniques. All of these methods are now in excellent agreement. With Fornax we are now at a turning point in this field."

The team is measuring Cepheid distances to the Virgo and Fornax clusters of galaxies as a complementary test. Their strategy is to compare and contrast expansion numbers from a variety of distance indicators.

The Key Project team is systematically looking into a variety of methods for measuring distances. They are using Cepheids in a large sample to tie into five or six "secondary methods". One such secondary method relates the total luminosity of a galaxy to the rate at which the galaxy is spinning, the Tully-Fisher relation. Another secondary method makes use of a special class of exploding star known as a type Ia supernova. This phase of the Hubble Constant research will be completed within another two years.

In contrast, the Sandage team focused on a single secondary distance indicator, one of the same indicators also used by the Key Project team, the type Ia supernova. Sandage maintains that these stars are "standard bombs" according to theory. He suggests that when they explode they all reach exactly the same intrinsic brightness. This would make them extremely reliable "standard candles," (objects with a well-known intrinsic brightness) visible 1,000 times farther away than Cepheids. Since they are intrinsically brighter than any other standard candle, they offer the opportunity for an accurate measurement of the Universe's overall expansion by looking out the farthest.

Although both teams are still in disagreement over the precise rate at which the Universe is expanding and on how old it is, they are optimistic that their estimates will continue to converge with further observations and analysis.

The Space Telescope Science Institute is operated by the Association of Universities for Research in Astronomy, Inc. (AURA), for NASA, under contract with the Goddard Space Flight Center, Greenbelt, MD. The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency (ESA).

- end -

EDITOR'S NOTE: Images accompanying this release are available to news media representatives by calling the Headquarters Imaging Branch on 202/358-1900. Photo numbers are:

	color	B&W
NGC 1365	96-HC-308	96-H-308
NGC 4639	96-HC-309	96-H-309

-more-

Image files in GIF and JPEG format and captions may be accessed on Internet via anonymous ftp from ftp.stsci.edu in /pubinfo.

	GIF	JPEG
NGC 1365	gif/NGC1365.gif	jpeg/NGC1365.jpg
NGC 4639	gif/NGC4639.gif	jpeg/NGC4639.jpg

Higher resolution digital versions (300dpi JPEG) of the release photographs will be available temporarily in /pubinfo/hrtemp: 96-21a.jpg and 96-21b.jpg (color) and 96-21abw.jpg and 96-21bbw.jpg (black/white).

GIF and JPEG images, captions and press release text are available via World Wide Web at URLs:
http://www.stsci.edu/pubinfo/PR/96/21.html and via links in:
http://www.stsci.edu/pubinfo/Latest.html or
http://www.stsci.edu/pubinfo/Pictures.html

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. NASA releases also are available via CompuServe using the command GO NASA.

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
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For Release

Debbie Rivera
Headquarters, Washington, DC
May 10, 1996
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VIDEO ADVISORY: V96-54

MIRROR IS READY FOR THE NEXT GREAT OBSERVATORY, NTV MONDAY

On Monday NASA TV will air video of the completed High Resolution Mirror Assembly for NASA's next great observatory - the Advanced X-ray Astrophysics Facility (AXAF). Also airing Monday are replays of the Saturn V move to its new home at the Kennedy Space Center,with possible new pictures of relocating the final piece.

ITEM #1: THE NEXT GREAT OBSERVATORY
Mirror is major milestone on the road to launch for AXAF.

ITEM #2: INTERVIEW - JOHN HUMPHRIES AXAF PROJECT MANAGER

ITEM #3: INTERVIEW - MARTIN WEISSKOPF, ASTRONOMER

ITEM #4: NEW HOME FOR SATURN V (POSSIBLE)
Final piece of Saturn V is moved.

ITEM #5: REPLAY - THE SATURN V IS MOVING
ITEM #6: REPLAY - DELTA CLIPPER TO RESUME FLIGHT
ITEM #7 REPLAY - INTERVIEW - CURTIS NcNEAL DC-XA DEPUTY PROGRAM MANAGER

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NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
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Jim Cast
Headquarters, Washington, DC
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For Release
May 10, 1996

RELEASE: 96-95

NASA ANNOUNCES 1996 STTR PHASE I SELECTIONS

NASA has selected 35 research proposals for immediate negotiation of Phase I contracts as part of the 1996 Small Business Technology Transfer Pilot Program (STTR).

The 1996 Phase I solicitation closed on January 25, 1996. One hundred and one separate proposals were submitted by 75 small, high technology businesses from all sections of the United States. Research topics included: general aviation, access to space, advanced technology for space science, and human exploration and development of space.

All proposals were peer reviewed for both technical merit and commercial potential. Six NASA field centers participated in these evaluations. Each of the 35 selected proposals will be awarded a fixed-price contract valued up to $100,000 with 12 months to complete their Phase I projects.

The STTR program requires small business concerns to conduct cooperative research and development by partnering with a research institution. At least forty percent of the work must be performed by the small business concern, and at least thirty percent must be performed by the research institute.

Companies that successfully complete Phase I activities are eligible to compete for Phase II awards the following year. The Phase II award process allows for two-year, fixed-price contracts of up to $500,000.

- end -

A complete listing of the selected STTR Phase I selectees is available via the Internet and anonymous ftp at: **ftp.hq.nasa.gov/pub/pao/pressrel/1996/sttr.txt**
Mailed hard copy of the list is available from the Headquarters Newsroom at 202/358-1600.

News Release

National Aeronautics and
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For Release
May 10, 1996

RELEASE: 96-96

SPACE STATION AIR PURIFICATION SYSTEM COMPLETES MAJOR TEST

The system that will purify the air aboard the International Space Station recently passed a major test at NASA's Marshall Space Flight Center, Huntsville, AL. The month-long test evaluated the system's ability to control carbon dioxide, oxygen and air pressure inside the Station's living and laboratory quarters.

Simulating the breathing activity of a crew of four, engineers injected carbon dioxide and water vapor, and removed oxygen from the school bus-size, 6,200-cubic-foot test module throughout the 30-day test to evaluate an air purification system.

"The test provided an excellent demonstration of the capability for maintaining cabin air composition using control procedures to be used onboard the Space Station," said Jay Perry, test principal investigator and life support engineer of Marshall's Thermal and Life Support Division. "Throughout the test, the system operated in a fully-automated fashion and its components responded very well to the simulated human breathing," explained Perry. The test was the fifth in a series begun in 1987.

The test also featured operation of the carbon dioxide removal system at reduced levels to save power. The test system operated at full power levels during the 53-minute daytime portion of the orbit and at lower levels during the 37-minute nighttime orbit, just as planned for Space Station. The nitrogen and oxygen composition of the atmosphere was controlled by signals from an air composition monitor, and special computer software very similar to that planned for use on the Space Station was developed for automated control during the test.

-more-

The Atmosphere Revitalization Subsystem demonstrated the capability of providing a healthy working environment for the crew and achieved a power savings of up to 200 watts over previous operating modes. These savings are significant and represent additional electrical power available for science experiments onboard the Space Station, Perry said.

Additional testing is planned to determine the capability of the various subsystems to remove other trace contaminants. The air purification hardware is scheduled to be launched to the U.S. Laboratory Module in 1998.

Marshall is conducting a variety of air purification tests in support of the Space Station Program Office.

-end-

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
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For Release

Debbie Rivera
Headquarters, Washington, DC
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May 13, 1996

VIDEO ADVISORY: V96-55

SLICK TESTING FOR SUPERSONIC FLIGHT, NTV TUESDAY

On Tuesday NASA TV will air video on how the Total In-flight Simulator (TIFS) provides engineers and pilots a way to test the next-generation High Speed Civil Transport (HSCT) without having to build an actual airplane. Also airing Tuesday is a low-cost navigational system that enables aircraft mapping of ice sheets to find potential effects of global climate change.

ITEM #1: LEARNING TO FLY SUPERSONIC
Testing the Total In-flight Simulator.

ITEM #2: INTERVIEW - MIKE PARRAD, TEST PILOT/ENGINEER, CALSPAN CORPORATION

ITEM #3: INTERVIEW - CAREY BUTTRILL, NASA ENGINEER

ITEM #4: ICY SHEETS
Economical aircraft mapping of Greenland ice sheets for effects of global climate change.

ITEM #5: REPLAY - AXAF ASSEMBLY

ITEM #6: REPLAY - INTERVIEW - JOHN HUMPHRIES AXAF PROJECT MANAGER

ITEM #7: REPLAY - INTERVIEW - MARTIN WEISSKOPF, ASTRONOMER

ITEM #8: REPLAY - NEW HOME FOR SATURN V

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-end-

News Release

National Aeronautics and
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For Release
May 13, 1996

RELEASE: 96-97

NASA AWARDS PRECOLLEGE GRANTS TO NINE UNIVERSITIES

NASA's Office of Equal Opportunity Programs announced the selection of nine minority universities to receive a three-year grant, Precollege Awards for Excellence in Mathematics, Science, Engineering, and Technology (PACE/MSET), for educational outreach projects.

Each university will receive up to $100,000 per year for the three years of the grant based on performance and availability of funds under the program.

The grants are intended to help students who have historically been underrepresented in college-preparatory mathematics and science classes gain the skills necessary to pursue science, engineering and related fields in college.

The selected universities to receive grants are:

California State University, Los Angeles, CA
Elizabeth City State University, Elizabeth City, NC
Fayetteville State University, Fayetteville, NC
Hampton University, Hampton, VA
Lehman College, Bronx, NY
Northwest Indian College, Bellingham, WA
Pasadena City College, Pasadena, CA
Southwestern Indian Polytechnic, Albuquerque, NM
Saint Augustine's College, Raleigh, NC

The grant program targets institutions of higher education, especially Historically Black Colleges and Universities, Hispanic Serving Institutions, Tribal Colleges and other minority universities whose student enrollment of underrepresented minorities exceeds 50 percent.

The PACE/MSET grant program is sponsored by the Office of Equal Opportunity Programs, Washington, DC.

-end-

News Release

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May 13, 1996

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RELEASE: 96-98

PROGRESS TOWARDS COMPLETION OF NEXT GREAT OBSERVATORY

A major milestone on the road to launch of NASA's next Great Observatory, the Advanced X-ray Astrophysics Facility (AXAF), has been passed with the completion of the High Resolution Mirror Assembly, following the successful application of a special reflective coating to the eight cylindrical mirrors. Integration of the assembly is now underway.

Reflective coating was applied to the AXAF mirrors at Optical Coating Laboratory, Inc., Santa Rosa, CA, using a special process to insure full and uniform coverage of the mirror's curved surfaces. One-by-one, the eight mirrors were placed in a vacuum chamber and rotated slowly as a thin layer of chromium and iridium, equivalent to about one-millionth of an inch, was applied to the inside of the telescope's cylindrical shaped mirrors. The coating of the X-ray mirrors aids in reflecting X-rays along the length of the telescope to the focal point.

"The precision optical coating work has exceeded specification requirements for the mirror's reflectivity," said AXAF Telescope Project Manager John Humphreys of the Marshall Space Flight Center, Huntsville, AL. "We have verified there is virtually no added surface roughness and no degradation to the highly polished surfaces of the eight mirrors," said Humphreys.

The mirrors of AXAF's X-ray telescope are very different from those in optical telescopes. The AXAF mirrors are cylindrical in shape with inner surfaces finely polished to precise, mathematically determined, geometric shapes. X-rays enter the front of the telescope and reflect off of the inner

-more-

surfaces of the mirrors at very shallow or grazing angles, almost like a stone skipping over water, finally coming to a focus behind the mirrors. The cylinder-like mirrors are used in pairs, with each pair "nested" inside the next larger set so that the frontal, energy-collecting area of the telescope is as large as possible.

Data from the observatory will be used to study X-ray radiation and is expected to significantly improve scientific understanding of some of the most energetic and violent processes in the universe.

The observatory will produce picture-like images and spectrograms which will yield information on temperature and chemical composition of objects it observes. Among the objects to be observed are neutron stars, black hole candidates, debris from supernova explosions, quasars, the centers of active galaxies and hot gas in individual galaxies and clusters of galaxies. Once operational, AXAF will provide scientists with the most detailed views of the universe ever obtained through observation of X-ray emissions.

The telescope's eight mirrors are being integrated into the High Resolution Mirror Assembly at the Eastman Kodak Company, Rochester, NY. TRW is the prime contractor for the AXAF observatory.

In 1996, all of the AXAF flight optics and detectors required to meet the science mission objectives will be aligned and tested in the X-ray Calibration Facility at Marshall, where the AXAF project is being managed.

AXAF is designed to be complementary to NASA's Great Observatories already in orbit -- the Hubble Space Telescope launched in 1990, and the Compton Gamma-Ray Observatory, launched in 1991. Each observatory makes observations of stars, galaxies, and other astronomical objects in distinct and separate wavelengths of energy, including visible light, ultraviolet, gamma rays, and, in the case of AXAF, X-rays. Launch of the AXAF is scheduled for August 1998.

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News Release

National Aeronautics and
Space Administration

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For Release

May 14, 1996

Keith Koehler
Wallops Flight Facility, Wallops Island, VA
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RELEASE: 96-99

LOW-COST AIRCRAFT NAVIGATION SYSTEM TO AID GLOBAL CLIMATE CHANGE STUDIES

A low-cost aircraft navigational system developed by NASA is making it possible for scientists to make precise maps of ice sheets that should yield valuable data on the potential effects of global climate change.

The system, which uses a personal computer to provide navigational data to the cockpit, allows aircraft pilots to fly flight paths to an accuracy of one foot. This allows the scientists on board the aircraft to map the icy terrain below to an accuracy of 4 inches.

NASA and university researchers today began their sixth mission since 1991 to map the ice sheets of Greenland. These missions are providing researchers with a baseline set of measurements to help them better understand glacial changes that may be due to global climate change.

The new navigation system that is aiding these researchers took less than six months to develop, according to Wayne Wright, system developer at the NASA Goddard Space Flight Center's Wallops Flight Facility, Wallops Island, VA. The system currently uses an IBM-compatible 486 personal computer, but it can be installed in an aircraft using a lap-top computer. "The total cost of the system is less than $3,000," Wright said.

A receiver in the aircraft tuned to the Global Positioning System of orbiting satellites acquires precise position information and then compares these readings to a predetermined flight path. The navigation system then generates steering signals that are sent to the autopilot to direct the aircraft toward its optimal path.

In addition, the system presents an aircraft position display to the pilot. This display allows the pilot to determine if the aircraft is right or left of the flight path centerline to within one foot. The system also can show the pilot position data on a larger scale, or the "big picture," such as the entire flight path.

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"The system can be used on other aircraft-based Earth science missions to map varied terrain such as volcanoes and coastlines," Wright said.

NASA pilot Rich Rogers compares using the navigational system to interacting with an aircraft piloting video game. "Flying science 'lines' requires great precision, and is both challenging and fun at the same time," Rogers said. Close coordination between the pilots, the aircraft flight crew and science team is needed to successfully operate the navigation system and accomplish the Greenland mission, he added.

NASA ice mapping project scientist Bill Krabill calls the system "absolutely critical to be able to refly flight lines with a tolerance of 150 feet," which is the scientific requirement. "It is the only means by which this project can be properly accomplished."

"In fact, the navigational system allows the aircraft to be flown within approximately 20 feet of previously measured points on the ice sheets," Wright said. This enables the researchers to both gather accurate measurements at a single data point and to record any regional changes from previous flights.

The current mission will include mapping previous data points over Greenland and new data points over Iceland and Spitsbergen. Points on the northern coast of Greenland are of particular interest because other satellite data indicate there is a possible decrease in the ice sheet's elevation, Krabill said.

It has been estimated that a 10-inch decrease in the average height of the central Greenland ice sheet would result in a 0.04 inch increase in sea level of the world's oceans.

During the mission, which runs from mid-May to mid-June, a P-3B aircraft from Wallops will carry four instruments for mapping the ice sheets. The instruments include a laser ranging system from Wallops called the Airborne Topographic Mapper I (ATM I), a profiling laser system from Goddard, and an ice-penetrating radar from the University of Kansas in Lawrence. The fourth instrument, still under development, is a smaller version of ATM I. The 400-pound ATM II is approximately half the size of the ATM I.

Researchers located on the ice in Greenland will conduct ground truth studies beneath the flight path of the aircraft to verify the airborne data. The field team includes researchers from Ohio State University in Columbus, the University of Arizona in Tucson, and the University of Nebraska in Lincoln.

The ice mapping program is conducted by Wallops for NASA's Office of Mission to Planet Earth, Washington, DC.

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Video Advisory

National Aeronautics and
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For Release

Deanna Corridon
Headquarters, Washington, DC
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May 15, 1996

VIDEO ADVISORY: V96-56

HOT ENCOUNTER WITH COMET HYAKUTAKE, STS-77 ON NTV WEDNESDAY

On Wednesday NASA TV will televise images of Comet Hyakutake as it was observed by the Naval Laboratory's Large Angle Spectrometric Coronagraph (LASCO) during its closest approach to the Sun. The LASCO is orbiting in deep space on board the ESA-NASA SOHO satellite. NTV also will transmit animation and astronaut interviews for the upcoming STS-77 mission. Replaying on NTV will be footage of the Total In-Flight Simulator and mapping ice in Greenland.

ITEM #1: HOT ENCOUNTER
The Naval Research Laboratory's Large Angle Spectrometric Coronagraph observes Comet Hyakutake.

ITEM #2: TAILS OF A COMET
Sequence shows comet with three tails visible.

ITEM #3: INTERVIEW - DR. GUENTER BRUECKNER, NAVAL RESEARCH LABORATORY
Discusses how LASCO was able to observe the comet.

ITEM #4: STS-77 ANIMATION
Depicts mission activities for STS-77.

ITEM #5: STS-77 CREW TRAINING
STS-77 crew prepares for upcoming mission.

ITEM #6: INTERVIEW - JOHN CASPER, STS-77 COMMANDER

ITEM #7: INTERVIEW - CURTIS BROWN, STS-77 PILOT

ITEM #8: INTERVIEW - DANIEL BURSCH, STS-77 MISSION SPECIALIST

ITEM #9: INTERVIEW - MARIO RUNCO JR., STS-77 MISSION SPECIALIST

ITEM #10: INTERVIEW - MARC GARNEAU Ph.D., STS-77 MISSION SPECIALIST

ITEM #11: INTERVIEW - ANDREW THOMAS, STS-77 MISSION SPECIALIST

ITEM #12: REPLAY - LEARNING TO FLY SUPERSONIC
ITEM #13: REPLAY - INTERVIEW - MIKE PARRAD TEST PILOT/ENGINEER CALSPAN CORP.
ITEM #14: REPLAY - INTERVIEW - CAREY BUTTRILL NASA RESEARCH ENGINEER
ITEM #15: REPLAY - ICY SHEETS

Video news files air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

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For Release
May 15, 1996

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Naval Research Laboratory, Washington, DC
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RELEASE: 96-100

SOHO IMAGES COMET HYAKUTAKE'S CLOSE ENCOUNTER WITH THE SUN

NASA, the European Space Agency (ESA) and the Naval Research Laboratory (NRL) have released a set of unprecedented images representing a time lapse movie of Comet Hyakutake making its close approach to the Sun.

The observations were made during April 29 - May 6, 1996 with the NRL-built Large Angle Spectrometric Coronagraph (LASCO) instrument on the Solar and Heliospheric Observatory (SOHO) spacecraft. The comet, estimated to have an orbital period of 10,000 years, came within about 20 million miles of the Sun and is seen in the images against the background of the million-degree hot outer atmosphere of the Sun, the corona.

"Such observations require a special instrument in space to suppress the glare of the Sun and reveal the comet and its tails," said Dr. Guenter Brueckner, NRL's principal investigator for LASCO. Scattering of sunlight in the Earth's atmosphere prevented good views from the ground during the comet's "perihelion passage," when it was closest to the Sun.

When the comet enters the outer atmosphere of the Sun, it begins to react with the Sun's environment and can be used as a "probe" of the solar corona. The LASCO images show the head of the comet, and clearly visible are three separate tails that behave differently as Hyakutake swings around the Sun. These tails are made of different materials which react differently with their environment. Heavy particles follow the comet in its orbit without being redirected by an outside force while the light dust particles are lining up away from the Sun and are driven by the Sun's intensive radiation. Finally, atomic particles are repelled from the comet by the solar wind and presumably line up with the magnetic field of the solar corona. The comet's tails could clearly be seen changing their relative direction over the seven day observation period as the Sun's forces acted upon them.

-more-

Hyakutake's orbit carries it back into the so-called "Oort Cloud," a vast collection of billions of comets that is located 1.4 light years away from the solar system.

Coronal mass ejections also were observed by LASCO, in which hot gases were expelled and accelerated by the corona's magnetic field to travel through the interplanetary medium. A strong reaction between such a solar high-speed cloud and the portion of the comet's tails made of atomic particles are expected when Hyakutake crosses the equatorial plane of the Sun. The comet was out of LASCO's field-of-view during this crossing, but the scientists will have another opportunity when Hyakutake reappears from behind the Sun and can be seen later in the southern hemisphere's night sky with ordinary telescopes. Researchers expect to learn more about the tails of the comet and the surrounding solar corona with more detailed analysis.

LASCO is a joint project between NRL, the Max Planck Institut fur Aeronomie (Germany), the Laboratoire d'Astronomie Spatiale (France), and the School of Physics and Space Research at the University of Birmingham (UK). SOHO is a project of international cooperation between ESA and NASA.

More information can be found on the LASCO Comet Hyakutake page on the World Wide Web at URL: http://lasco-www.nrl.navy.mil/b2-1996.html.

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EDITOR'S NOTE: Two images to illustrate this release are available to media representatives by calling Headquarters Imaging office at 202/358-1900. Photo numbers are:

	Color	B&W
4-frame image	96-HC-312	96-H-312
Coronograph	96-HC-313	96-H-313

The video is available by calling the Naval Research Laboratory at 202/767-2541.

Video Advisory

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May 16, 1996

VIDEO ADVISORY: V96-57

RUGGED MONTANA REVEALED AND MARINE LIFE TRAVELS TO SPACE ON NTV THURSDAY

On Thursday NASA TV will televise an animated sequence which depicts travel through the rugged Montana landscape. The animation is based on radar elevation data obtained by the SIR-C/X-SAR imaging radar system as it made two orbital passes on board the Shuttle. Also airing Thursday is the Aquatic Research Facility (ARF), which is a joint Canadian Space Agency/NASA project that will permit scientists to analyze reproductive processes and feeding behaviors of marine life while living in microgravity. Replaying on NTV will be images of Comet Hyakutake as it was observed by the SOHO spacecraft during the comet's closest approach to the Sun, and B-roll of mission activity animation, training and astronaut interviews for the upcoming STS-77 mission.

ITEM #1: BIG SKY FROM ABOVE (TENTATIVE)
Animation based on data gathered from the SIR-C/X-SAR imaging radar system depicting navigation across Montana.

ITEM #2: REPLAY - HOT ENCOUNTER
ITEM #3: REPLAY - TAILS OF A COMET
ITEM #4: REPLAY - INTERVIEW - DR. GUENTER BRUECKNER, NAVAL RESEARCH LABORATORY
ITEM #5: REPLAY - STS-77 ANIMATION
ITEM #6: REPLAY - STS-77 CREW TRAINING

ITEM #7: SPACE AQUARIUM
Marine organisms become passengers on Canada's first life science payload in space.

ITEM #8: INTERVIEW - ALAN MORTIMER, CHIEF OF LIFE SCIENCES, CANADIAN SPACE AGENCY
Discusses possible benefits of the Aquatic Research Facility.

ITEM #9: REPLAY - INTERVIEW - JOHN CASPER, STS-77 COMMANDER
ITEM #10: REPLAY - INTERVIEW - CURTIS BROWN, STS-77 PILOT
ITEM #11: REPLAY - INTERVIEW - DANIEL BURSCH, STS-77 MISSION SPECIALIST
ITEM #12: REPLAY - INTERVIEW - MARIO RUNCO JR., STS-77 MISSION SPECIALIST
ITEM #13: REPLAY - INTERVIEW - MARC GARNEAU Ph.D., STS-77 MISSION SPECIALIST
ITEM #14: REPLAY - INTERVIEW - ANDREW THOMAS, STS-77 MISSION SPECIALIST

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May 16, 1996

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RELEASE: 96-101

MEASUREMENTS FROM ULYSSES GIVE NEW CLUES TO DARK MATTER

Measurements from the joint NASA/European Space Agency Ulysses mission found a surprisingly small increase in the amount of helium-3 since the formation of the solar system, allowing a more precise estimate of the amount of dark matter in the universe, two scientists announced today. Their findings, from measurements of the Solar Wind Ion Composition Experiment aboard Ulysses, were published today in Nature magazine

Drs. George Gloeckler, professor of physics at the University of Maryland, and Johannes Geiss, director at the International Space Sciences Institute in Bern, Switzerland, reported the first measurements of helium-3 in the interstellar cloud surrounding our solar system. They said their findings of this lighter isotope of helium give additional clues to the amount of dark, or invisible matter, that was produced at the beginning of the universe -- the Big Bang -- 15 billion years ago.

The exact nature of dark matter is one of the most intriguing mysteries in astronomy. Although scientists do not know what it is, their best estimates indicate most of the Universe -- perhaps as much as 90 per cent -- is composed of dark matter. This estimate is based partly on observations showing stronger gravitational attraction between galaxies than should be the case with the amount of matter they can see. The dark matter may be 'ordinary' matter such as planets and burned-out stars too dim to detect, or perhaps exotic objects such as black holes or as-yet undetected particles which pervade the Universe.

- more -

"Basically, our measurements indicate the amount of dark matter in the early universe was fairly high," Gloeckler said. "Visible matter is a small fraction of the total. By measuring the relative portions of the lightest elements and their isotopes, one can infer the amount of ordinary matter in the universe."

"Since current theories of the earliest stages of the universe predict a much larger amount of matter coming out of the Big Bang, the difference is surmised to consist of an entirely different and unfamiliar kind of matter, commonly called dark matter," Geiss said. "The precise nature of this dark matter is not known at this time, because it has eluded so far all efforts of detecting it directly. It could very well have survived to this day, filling the whole universe and dominating its dynamics, yet be invisible to us."

The light elements of helium-3, hydrogen, deuterium -- a heavy isotope of hydrogen -- and helium-4 were created in the Big Bang, the scientists said. The abundance of helium-3 has been changing ever since because it is both produced and destroyed in stars.

The direction and amount of this change have until now remained undetermined, they said. They found, however, that the reported amount of helium-3 indicates a surprisingly small increase -- about 50 percent -- since the time of the formation of the solar system 4.6 billion years ago.

Since the change was smaller than earlier models indicated, Gloeckler and Geiss said, the density of dark, or unseen, matter relative to that matter which we can see must be greater.

"What is so exciting is that we have good numbers for the helium-3 abundance during three time epochs spanning the life of the universe," Gloeckler said. "This gives a firm handle on how matter is processed or 'cooked' in stars."

He said current models that predict large amounts of helium-3 are not consistent with the new findings.

The measurements were made over the south pole of the Sun at distances several times the distance of the Sun to Earth. They detected the interstellar gas that made its way deep into the inner solar system and determined the composition of helium-3 in that gas.

The Ulysses mission is managed jointly by NASA and the European Space Agency (ESA). The Jet Propulsion Laboratory manages the U.S. portion of the mission for NASA's Office of Space Science, Washington, DC.

- end -

Video Advisory

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For Release

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May 17, 1996

VIDEO ADVISORY: V96-58

BUOYS, CLEANERS, AND LAUNCHES ON NTV FRIDAY

On Friday NASA TV delivers a smorgasbord of images, including: students launch a buoy to talk to a satellite and record oceanic statistics; NASA researcher will market new space age cleaner; astronauts arrive and countdown begins for the launch of STS-77; and, B-roll of experiments to go up on this mission. Also replaying on NTV will be images of rugged Montana, B-roll of mission activity animation, training and astronaut interviews for the upcoming STS-77 mission., and marine life in space.

ITEM #1: BUOYS IN GALVESTON BAY
Students launch buoys into Galveston Bay, TX to verify altimeter measurements from the TOPEX/Poseidon satellite.

ITEM #2: INTERVIEW - AMY NEUENSCHWANDER, UNIV. OF TEXAS CTR. FOR SPACE RESEARCH
Discusses the TOPEX student program.

ITEM #3: SUPERSONIC CLEANER
Supersonic cleaning system doesn't abrade delicate surfaces.

ITEM #4: INTERVIEW - RAOUL CALMI, NASA DESIGN ENGINEER
Discusses the benefits of using a non-abrasive cleaner.

ITEM #5: REPLAY - BIG SKY FROM ABOVE

ITEM #6: INTERVIEW WITH SHANNON LUCID
Dr. Lucid discusses life on the Mir Space Station with German TV.

ITEM #7: STS-77 CREW ARRIVAL
Replay of STS-77 crew arrival at the Kennedy Space Center, FL.

ITEM #8: INFLATABLE ANTENNAE
Animation depicts antenna deployment from the Spartan payload for the upcoming STS-77 mission.

ITEM #9: INFLATABLE HISTORY
Testing of the Spartan and Inflatable Antenna Experiment at the Goddard Space Flight Center, Greenbelt, MD.

ITEM #10: INTERVIEW - MARK STEINER
Discusses the Inflatable Antenna Experiment.

ITEM #11: HITCHHIKER IN SPACE
The Hitchhiker (HH) experiment payload will carry four Technology Experiments for Advancing Missions in Space (TEAMS).

ITEM #12: INTERVIEW - NEAL BARTHELME
Explanation of the TEAMS experiments.

THE REMAINDER OF THE VIDEO FILE WILL CONTAIN REPLAYS OF THE UPCOMING STS-77 MISSION B-ROLL, AND SIR-C IMAGES OF MONTANA FROM YESTERDAY'S FEED.

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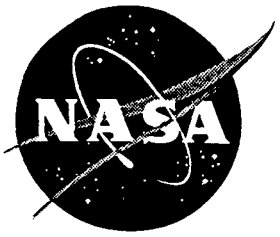

For Release

May 17, 1996

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RELEASE: 96-102

NEW NASA NON-ABRASIVE CLEANING SYSTEM LICENSED TO INDUSTRY

A new supersonic cleaning system that does not damage surfaces has been developed by engineers at NASA's Kennedy Space Center, FL, and may soon be used to remove contaminants from Space Shuttle hardware and other sensitive structures.

Because the Supersonic Gas-Liquid Cleaning System is so unique in its design and potential effectiveness, separate patent license agreements have been developed between Kennedy and two independent companies for commercial applications. The companies are Precision Fabricating and Cleaning Co. of Cocoa, FL, and Va-tran Systems, Inc., of Chula Vista, CA. The agreement is a means for NASA to effectively transfer technology initially developed for the space program to companies that may derive innovative commercial uses from it.

One of the many advantages of the Supersonic Gas-Liquid Cleaning System over other pressurized cleaning methods is that it does not abrade the surface of the hardware being cleaned. It requires much lower levels of pressure while using very little water. These features allow the system to be used for cleaning anything from small electronic circuit boards to much larger historic monuments and buildings.

"We don't need to use as high a pressure as in some cleaning systems," said Eric Thaxton, one of the system designers at Kennedy, "because the energy is provided by the nozzle's supersonic design." The system works by mixing air and water from separate pressurized tanks and ejecting this mixture at supersonic speeds from a series of nozzles at the end of a hand-held wand, explained NASA lead project engineer Raoul Caimi. At these speeds, the water droplets have the kinetic energy to forcibly remove the contaminant material.

-more-

This technology also is environmentally friendly. It was developed as an alternative to chlorofluorocarbon (CFC)-based solvents. "During our testing programs," Caimi said, "we found that the gas-liquid supersonic system actually does a better job of cleaning than the system that uses CFCs."

Also, the relatively low volume of water required, less than 100 milliliters per minute, means there is less fluid left after cleaning that must be handled as contaminated industrial or hazardous waste.

Va-tran Systems director of engineering Jeffrey Sloan feels that the Kennedy invention will add an exciting technology to the company's current precision cleaning capabilities. "We anticipate greatly expanded markets as we begin to serve automotive, aerospace, heavy manufacturing and other industries," he said.

Bill Sheehan, chief of Kennedy's Technology Programs and Commercialization Office, said, "This is an innovative system that is recognized by industry to have many potential uses in the commercial market. We feel that it serves as a good example of how technology developed for use in the space program can benefit the country's industry and the public."

-end-

Editor's Note: Industry representatives who would like more information on the new cleaning system or are interested in licensing this NASA technology should contact the Technology Programs and Commercialization Office, DE-TPO, Kennedy Space Center, FL 32899 or call (407)867-3017.

News Release

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For Release

May 21, 1996

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RELEASE: 96-103

GALILEO PROBE DATA SPURS NEW CONCEPTS FOR JUPITER'S CIRCULATION AND FORMATION

Measurements returned by NASA's Galileo probe into Jupiter have provided dramatic new evidence about circulation processes within the planet's atmosphere and prompted scientists to propose radical new theories about Jupiter's original formation.

The new concepts arise from the probe's successful parachute-borne descent into Jupiter on Dec. 7, 1995. The probe made the first quantitative measurements of the Jovian atmosphere below its outer clouds, reaching a region below where heat from the Sun can penetrate. This means the probe sampled the upper part of what is believed to be Jupiter's well-mixed, relatively uniform "interior atmosphere."

Several members of the probe scientific team announced new mid-term findings today at a meeting of the American Geophysical Union in Baltimore. "The returns from the probe's scientific instruments have sparked a lively worldwide scientific debate about theories of planetary formation and about internal mechanisms in the huge Jovian atmosphere," according to Dr. Richard Young, Galileo probe scientist at NASA's Ames Research Center, Mountain View, CA.

Prior to the probe mission, the leading theory of Jovian weather assumed that, like on Earth, most action occurs in the thin, cloudy, solar-heated exterior region -- the so-called "skin of the apple." Winds within Earth's 100-mile-deep atmosphere are primarily the result of differential sunlight at the poles versus the equator, and heat released due to water condensation.

-more-

According to mission scientists, Galileo probe data strongly suggest that circulation patterns in Jupiter's cloud tops and its interior (which runs 10,000 miles deep) are part of one continuous process. Dr. David Atkinson of the University of Idaho continues to report persistent Jovian wind velocities of over 400 mph. The probe detected no reduction in wind speed, even at its deepest levels of measurement, approximately 100 miles below Jupiter's clouds.

Galileo scientists regard this finding as confirmation that the main driving force of Jupiter's winds is internal heat radiating upward from the planet's deep interior. The strength of the Jovian winds and the fact that they do not subside with depth is very significant, according to Dr. Andrew Ingersoll of the California Institute of Technology, Pasadena, CA.

"This may be evidence that Jupiter has high-speed wind currents extending thousands of miles deep into its hot, dense atmosphere," Ingersoll said. Such interior currents are believed by probe scientists to be the source of the dramatic banded appearance of Jupiter's cloud tops.

The most difficult probe finding for scientists to explain continues to be the extreme lack of water detected in the Jovian atmosphere. Pre-probe mission scientific estimates based on planetary formation theories, data from the earlier NASA Voyager spacecraft flybys of Jupiter and observations from the impacts of the fragments of Comet Shoemaker-Levy 9 with Jupiter forecast Jovian water levels at or well above those found in the Sun. However, probe scientists report that Jupiter is extremely dry -- with water levels (based on oxygen content) at one-fifth to one-tenth of the solar amount.

This finding is now well established, having been confirmed by analysis of data from five of the probe's science instruments. For example, the virtual absence of Jovian water clouds and the low relative frequency of lightning are all consistent with dry atmospheric conditions. Where is the water that should remain from Jupiter's formation in the same primitive nebula of gas and dust that spawned the Sun and the other planets? Several theories have been proposed.

According to one theory, Jupiter's true total water levels are probably at or above solar, with the bulk of Jovian water trapped in the planet's deep interior. According to this view, Jupiter began as a solid, rocky/icy proto-planet that grew to 8-10 times the mass of the Earth by gathering up ice grains and dust in the original primordial cloud. This process may well have concentrated water ice in the solid body, trapping it in the core while drying out surrounding regions.

As the solid body of the proto-Jupiter became larger, it attracted the already-dried-out surrounding lighter gases, mixing them with its existing atmosphere. This atmosphere would contain carbon and other gases that were originally locked in the core but had escaped as methane, ammonia, hydrogen sulfide and other volatiles as the core heated up. This process would produce a gas mixture similar to that found by the Galileo probe. It also would explain the enhanced carbon, sulfur and nitrogen levels found on Jupiter, which are significantly enriched relative to their abundance on the Sun.

In fact, this water-locked-in-the-Jovian-interior theory explains many of the measurements made by the probe. However, "there are problems with this new view, as there are with all the other current theories," said Dr. Tobias Owen of the University of Hawaii. "The primary one being, how does the ice stay in the hot planetary core while carbon-containing gases escape?"

An alternative theory suggests that the probe entered the Jovian atmosphere in an area comparable to the Earth's desert regions. This theory is supported by Earth-based telescopes and other spacecraft that observed extreme dryness at the probe's entry point on Jupiter's north equatorial belt. This theory holds that, like on Earth, Jupiter's atmosphere is heated by the Sun at the equator, causing air to rise until clouds form and water is lost. The dry air then may flow north and south, descending in "desert" regions. If a large enough downdraft exists, it might be sufficient to explain the dryness that the Galileo probe encountered.

However, several scientists find fault with this "huge downdraft" theory, doubting that such a massive downdraft and continued dryness could exist at the depth and pressure levels to which the probe descended. While such a downdraft might explain the observed dryness, its persistence down to 20 times Earth's atmospheric pressure is very hard to explain, according to Ingersoll.

"This explanation is particularly difficult when considering that Jupiter emits more heat from its interior than it receives from the Sun," he said. "This up-flowing interior heat should block a huge, deep downflow of dry air. It should evenly mix Jupiter's atmospheric water vapor at this pressure level, preventing the existence of a very dry region such as that found by the probe."

One possibility, Owen responds, is that "perhaps Jupiter's interior heat comes out only in certain regions where ascending currents bring up hot material from the planet's interior, like the heat escaping from the Earth's interior" in volcanoes and mid-ocean floor spreading zones.

A variation on the dry-region theory has been advanced by Young and others. "Jovian water distribution may vary radically over large latitude regions, with much of Jupiter's water being concentrated at high latitudes where most of the planet's lightning has been detected," he said. "More of Jupiter's interior heat is also emitted at high latitudes. Unfortunately, at the moment, we can't put all of this into a mechanism to explain how major parts of Jovian water could be concentrated uniquely at these high latitudes."

The Galileo probe successfully accomplished the most difficult planetary atmospheric entry ever attempted. It relayed a total of 61 minutes of unique science data to the Galileo orbiter passing 100,000 miles overhead for subsequent transmission to Earth. The probe descended about 400 miles into the Jovian atmosphere, taking measurements down to a level corresponding to 20 times Earth's atmospheric pressure. The Galileo orbiter has since embarked on a two-year tour of Jupiter and its moons.

Additional information on the Galileo probe, including a discussion of the craft's science instruments and a non-technical summary of the first scientific papers on the probe mission that were published in the May 10 issue of Science magazine, can be found on the Internet at the following URL:

http://ccf.arc.nasa.gov/galileo_probe/

The Galileo probe is managed by NASA's Ames Research Center, Mountain View, CA. Hughes Space and Communications Co., El Segundo, CA, designed and built the probe. Lockheed Martin Hypersonic Systems (formerly General Electric), Philadelphia, PA, built the probe's heat shield. NASA's Jet Propulsion Laboratory, Pasadena, CA, built the Galileo orbiter spacecraft and manages the overall mission.

- end -

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
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For Release

Deanna Corridon
Headquarters, Washington, DC
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May 22, 1996

VIDEO ADVISORY: V96-60

POLAR SPACECRAFT INSTRUMENTS REVEAL AURORAE ON NTV THURSDAY

On Thursday NASA TV will televise images of aurorae on Earth taken by several instruments on board the Polar spacecraft. Scientists will use the imaging data gathered to study the continuous effects of radiation and particle bombardment from the Sun which may eventually help predict "space weather." The auroras seen on Earth are one of the most spectacular effects of solar storms. Some of the more serious effects of solar storms are communication disruptions on Earth and electronic damage done to spacecraft. NASA TV also will air STS-77 Flight Day Highlights including SPACEHAB activities.

ITEM #1: BLINDED BY THE SUN
Video of aurorae compiled from the first ultraviolet images taken by the Ultraviolet Imager (UVI) on the Polar spacecraft.

ITEM #2: A GLOBAL X-RAY
Video of the Earth's aurora compiled from the first global x-ray images taken by the Polar Ionospheric X-ray Experiment (PIXIE) aboard the Polar spacecraft.

ITEM #3: EARTH X-RAY
Image of the first global x-ray image ever obtained of the Earth's aurora.

ITEM #4: NIGHT AND DAY
An image taken by the UVI showing the entire auroral oval.

ITEM #5: DYNAMIC DAYS AND INTENSE NIGHTS
Sequence showing the dayside aurora and the onset of an auroral substorm with intense nightside activity.

ITEM #6: FROM POLE TO POLE
File footage of the Polar spacecraft.

ITEM #7: INTERVIEW - DR. MARIO ACUNA - INT'L SOLAR-TERRESTRIAL PROJECT (ISTP) SCIENTIST
Explanation of the ISTP program.

ITEM #8: INTERVIEW - DR. GEORGE PARKS, ULTRAVIOLET IMAGER PRINCIPAL INVESTIGATOR
Discusses what UVI will study.

ITEM #9: INTERVIEW - DR. DAVID CHENETTE (PIXIE) PRINCIPAL INVESTIGATOR
Discusses how PIXIE is imaging x-rays over the Earth's polar regions.

ITEM #10: INTERVIEW - DR. JOHN SIGWARTH, VISIBLE IMAGING SYSTEM THE UNIVERSITY OF IOWA
Discusses how the Visible Imaging System will use three cameras to study the "northern and southern lights" from space.

ITEM #11: STS-77 FLIGHT DAY HIGHLIGHTS
Continuing highlights from Flight Day 5 on board the Space Shuttle Endeavour.

Video news files will air at 2:30, 4:00 , 8:00 and 10:00 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

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For Release
May 23, 1996

RELEASE: 96-105

SPACECRAFT SENDS BEST IMAGES YET OF EARTH'S NORTHERN, SOUTHERN LIGHTS

Scientists working with NASA's recently launched Polar satellite today released the best images ever made from space of the Earth's aurora. The images are being presented at the meeting of the American Geophysical Union in Baltimore, MD.

The new spacecraft data show remarkably clear views of the aurora borealis in the daytime. The new images and information will help scientists to better understand the transport of energy from the Sun to the Earth by the solar wind. POLAR also has acquired the first global images of the Earth's aurora in X-rays.

Data from the spacecraft is transmitted several times each day via the Deep Space Network to NASA's Goddard Space Flight Center, Greenbelt, MD, where it is processed and distributed for analysis. Goddard is managing the program and is responsible for operating the spacecraft.

Polar was launched from Vandenberg AFB, CA, on Feb. 24. It is orbiting the Earth every 17-1/2 hours in a large, elliptical orbit that carries the satellite high over the northern polar region. The satellite is a principal component of NASA's Global Geospace Science program, the first phase of NASA's Solar Connections Program and a primary U.S. contribution to the International Solar Terrestrial Physics Program.

The images from Polar may be viewed and downloaded from the Internet at the following URL:

http://pao.gsfc.nasa.gov/gsfc/newsroom/flash/flash.htm

Editor's Note: News media may obtain copies of these images by contacting the Goddard Public Affairs Office.

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News Release

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For Release

May 23, 1996

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RELEASE: 96-106

EARLY FINDINGS FROM TETHERED SATELLITE MISSION POINT TO REVAMPING OF SPACE PHYSICS THEORIES

Numerous space physics and plasma theories are being revised or overturned by data gathered during the Tethered Satellite System Reflight (TSS-1R) experiments on Space Shuttle Columbia's STS-75 mission last March.

Models, accepted by scientists for more than 30 years, are incorrect and must be rewritten. This assessment follows analysis by a joint U.S.-Italian Tethered Satellite investigating team of the information gathered during the mission.

During STS-75, a tether system was being unreeled to nearly 13 miles above Columbia's payload bay. Just short of the full distance, its tether broke. Nevertheless, the science instruments on the satellite and Shuttle, which had been operating during the five hours of deployment operations, sent a flood of readings that were received and recorded by scientists on the ground. -"Even the quick-look made to date reveals that this data harvest is rich in content," said Dr. Nobie Stone, NASA TSS-1R mission scientist at the Marshall Space Flight Center, Huntsville, AL.

"Perhaps the most significant finding," Stone said, "is that tether currents proved to be up to three times greater than existing theoretical models predicted prior to the mission. With the amount of power generated being directly proportional to the current, this bodes well for technological applications."

"Reversing the direction of current flow puts the system into an electric-motor mode," Stone explained. This harnessed energy could furnish thrust for reboosting a space station, satellite or Shuttle in a decaying orbit.

-more-

"Traditionally, the primary source of power for long-term space platforms has been solar arrays," Stone said. "Those cells can only produce power when exposed to sunlight during the two-thirds of each 90-minute orbit when a space station, for instance, is not on Earth's dark side. However, a tether system might provide a constant source of energy," he noted. "It is very efficient and might serve as an effective back up power system."

Other important revelations from the STS-75 mission include observations of the satellite's thrusters interacting with the ionosphere while moving rapidly in Earth orbit. Stone said that, when the thrusters were fired to adjust the satellite's spin rate, the neutral gas emitted became ionized.

The tethered satellite researchers noted that, at that point, "a sudden jump" took place in the level of current flow, while the satellite's potential (voltage) dropped several hundred volts. They traced this effect to the small amount of gas, released from the thrusters, becoming ionized in the vicinity of the satellite. A greater, more efficient current flow was observed. "The effect of neutral-gas ionization is not taken into consideration by existing theoretical models of current collection in the ionosphere," Stone said.

Also, for the first time ever, the high voltage plasma sheath and wake of a high-voltage satellite moving rapidly in the ionosphere was measured. "This is virtually impossible to study in a laboratory and is difficult to model mathematically," Stone said.

Tethered Satellite System investigators have just begun to scrutinize the data from STS-75. They expect that it will reveal more answers to questions about the workings of the Earth's upper atmosphere, its physics and the electrodynamic applications of tethered systems in space.

- end -

News Release

National Aeronautics and
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For Release
May 24, 1996

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NOTE TO EDITORS: N96-33

MIR 21 COSMONAUTS TO HOLD NEWS CONFERENCE

U.S. astronaut Shannon Lucid, now in her third month aboard the Russian Mir space station, will join Commander Yuri Onufrienko and Flight Engineer Yuri Usachev for a news conference at 9:40 a.m. EDT on Tuesday, May 28, from the Mir.

The news conference, which will be broadcast on NASA Television, will last 40 minutes and be divided into two parts; reporters at NASA centers will ask questions for the first 20 minutes before switching to the Russian Mission Control Center in Kaliningrad, where Russian reporters will ask questions for the last 20 minutes. The Russian portion of the news conference will be seen on NASA Television with English translation.

NASA Television can be seen on Spacenet 2, Transponder 5, channel 9 with a frequency of 3880 Mhz with audio on 6.8 Mhz. Spacenet 2 is at an orbital position of 69 degrees West longitude. Polarization is horizontal.

-end-

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For Release
May 24, 1996

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NOTE TO EDITORS: N96-34

NEXT SPACE SCIENCE UPDATE FEATURES "CRAB NEBULA -- THE MOVIE"

Fascinating new motion images from NASA's Hubble Space Telescope showing glowing, eerie shifting patterns of light and sharp wisp-like features streaming away from the center of the Crab nebula at half the speed of light will be the topic of the next Space Science Update. The briefing will be held at 2 p.m. EDT, on Thursday, May 30, from the NASA Headquarters Auditorium, 300 E St., S.W., Washington, DC.

Entitled "Crab Nebula: The Movie," astronomers will explain that being able to see the rapidly changing and dynamic activity in the Crab reveal that these processes are similar to those in the centers of distant active galaxies and quasars -- processes which Hubble is now revealing in great detail for the first time.

Panelists will be:

- Dr. Jeffrey Hester, Arizona State University,Tempe, AZ
- Dr. Paul Scowen, Arizona State University, Tempe, AZ
- Dr. Bruce Margon, University of Washington, Seattle
- Dr. Anne L. Kinney, Space Telescope Science Institute, Baltimore, MD
- Dr. Steve Maran, Goddard Space Flight Center, Greenbelt, MD

The Space Science Update will be carried live on NASA TV with two-way question-and-answer capability for reporters covering the event from participating NASA centers.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz. Audio of the broadcast will be available on voice circuit from the Kennedy Space Center on 407/867-1260.

- end -

Video Advisory

National Aeronautics and
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For Release

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May 25-28, 1996

VIDEO ADVISORY: V96-62

HIGHLIGHTS OF SHUTTLE/MIR ACTIVITIES ON NTV

NASA Television will transmit a replay of real-time footage of Russian space-walkers, Yuri Onufrienko and Yuri Ufachev unfurling a solar panel outside the Russian Space Station Mir at 12:20 a.m. EDT Saturday morning. The pictures could last up to one hour. The video will be replayed on NASA Television 5:30 a.m. EDT and 7:00 a.m. EDT Saturday.

On Monday, Flight Day 9 of the STS-77 mission, at 9:25 a.m. EDT there will be a communication link established between the Shuttle Endeavour and Mir, allowing Shannon Lucid and fellow Russian crew members on Mir to converse with each other.

On Tuesday, Flight Day 10 of the STS-77 mission, at 9:40 a.m. EDT there will be a Mir 21 Crew News Conference.

MAY 25, 1996 : MIR SPACE STATION SPACE-WALK
Two Russian cosmonauts deploy a solar array on Mir.

(Feed will be at 12:30 a.m. EDT, with replays at 5:30 a.m. and 7:00 a.m. EDT.)

MAY 27, 1996: ENDEAVOUR/MIR CONVERSATION
Communication link established between the Shuttle Endeavour and Mir.

(Feed will be at 9:25 a.m. EDT.)

MAY 28, 1996: MIR 21 CREW NEWS CONFERENCE
Astronauts on Mir discuss mission.

(Feed will be at 9:40 a.m. EDT.)

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

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News Release

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For Release
May 29, 1996

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CONTRACT AWARD: C96-d

PRATT & WHITNEY AIRCRAFT SELECTED FOR TECHNOLOGY DEVELOPMENT CONTRACT

NASA Lewis Research Center, Cleveland, OH, has awarded a $27 million five-year contract to United Technologies Corp., Pratt & Whitney Aircraft, of East Hartford, CT, to develop critical propulsion and engine noise reduction technologies for the next generation of U.S. subsonic commercial engines.

Under the cost-reimbursement-without-fee contract, critical advancements will be pursued to reduce nitrogen oxide emissions by 70 percent and reduce expected future engine noise levels. Research also will be conducted on engine technologies that will improve fuel efficiency by eight percent and direct operating costs by three percent.

Work to be performed under the propulsion category includes low emission combustor, validated aeroelastic codes for turbomachinery, design codes for hi-bypass ducts, advanced seals, lightweight affordable engine structures and advanced controls and accessories.

Areas of development for engine noise reduction technology include aerodynamic and aeroacoustic prediction code development and fan/nacelle noise reduction concept design and testing.

Contract results are expected to provide the technical data to address pending emission and noise regulations that will impact the large engines (20,000 to 100,000 lb. thrust) that will enter commercial services in the year 2000 to 2005.

The company will develop and demonstrate these technologies at their facilities in East Hartford, as well as at Lewis.

-end-

News Release

National Aeronautics and
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For Release

May 30, 1996

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NOTE TO EDITORS: N96-35

RESULTS OF TETHERED SATELLITE INVESTIGATION SET FOR JUNE 4

A press conference on the findings of the failure board that investigated the cause of the loss of the Tethered Satellite during the STS-75 Space Shuttle mission will be held at 2 p.m., Tuesday, June 4, in the NASA Headquarters auditorium, 300 E St., SW, Washington, DC.

Participants will be:

- Kenneth J. Szalai, chairman of the TSS-1R Mission Failure Board and Director of the Dryden Flight Research Center
- Andrew Allen, STS-75 Commander
- Dr. Carlo Bonifazi, Italian Space Agency (Agenzia Spaziale Italiana-ASI), Failure Board representative

The press conference will be carried live on NASA Television on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. The frequency is 3880.0 megahertz, with audio on 6.8 megahertz.

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NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. NASA releases also are available via CompuServe using the command GO NASA.

News Release

National Aeronautics and
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Washington, DC 20546
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For Release

May 31, 1996

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RELEASE: 96-108

CHEMICAL MEASUREMENTS OF COMET HYAKUTAKE SUGGEST A NEW CLASS OF COMETS

Astronomers observing the close approach of Comet Hyakutake to the Earth in March discovered large quantities of the gases ethane and methane in the comet. This is the first time these or other molecules classified as "saturated hydrocarbons" have been found in a comet, strongly suggesting that at least two basic types of comets inhabit the Solar System.

This conclusion also has potentially profound implications for scientific theories that describe the primordial conditions that led to the formation of the Sun and the planets.

The discovery by a team of NASA and university researchers using the NASA Infrared Telescope Facility at Mauna Kea, Hawaii, will be published in today's issue of Science magazine.

Ethane has never before been detected in comets or in interstellar matter, the ultimate source material from which the Solar System was formed. Yet, comet investigators found levels of ethane in Comet Hyakutake that are about 1,000 times greater than can be explained if the molecules were formed by normal physical processes within the gases of the primordial solar nebula, the birth cloud of the Solar System.

"The discovery of ethane was a blinding surprise," according to research team leader Dr. Michael J. Mumma of the Laboratory for Extraterrestrial Physics at NASA's Goddard Space Flight Center, Greenbelt, MD. The spectral lines, or identifying signature of ethane gas, "were so bright they seemed to leap off the computer screen when we got the first observation," Mumma said.

-more-

The discoveries were made on March 24, 1996, with the three-meter diameter telescope of the NASA Infrared Telescope Facility atop Mauna Kea. The investigators used a state-of-the-art instrument known as a high-resolution infrared spectrometer. The device was cooled to about minus 400 degrees Fahrenheit to achieve the needed sensitivity to infrared light, which has a longer wavelength than red light and cannot be seen with the human eye.

The unexpected ethane discovery came as the observers searched for evidence of molecules of methyl alcohol, a known constituent of other comets. However, "the emissions of methyl alcohol that we first looked at were much weaker than expected, so we decided to search for other signatures of the alcohol," said research team member Dr. Michael A. DiSanti of the Catholic University of America, Washington, DC. "But after reprogramming the spectrometer, instead of detecting methyl alcohol, we discovered ethane."

Further observations and analysis showed that ethane and methane each constitute about one percent of the frozen gases in Comet Hyakutake. (The astronomers measured radiation from gases released from their frozen state as the solid nucleus -- or "dirty iceball" -- of the comet was warmed by the Sun.)

"Comets that are rich in ethane must have experienced very different conditions during their birth than comets that do not contain it," Mumma said. One theory is that ethane-rich comets formed in the warmer region near the primitive Saturn and Jupiter, while those without it formed farther away from the young Sun, near the primitive Uranus and Neptune.

Another possibility is that cometary ices formed even earlier, in different layers of the original interstellar gas and dust cloud that led to the solar nebula. An even more challenging concept is that the vast sphere of comets that are believed to surround the Solar System, called the Oort Cloud, may contain comets that formed from different solar nebula -- that is, stars other than the Sun. Chemical and physical processes may have been at work in any scenario, altering the properties of the material that now makes up the comet's ice.

The discovery of ethane in Comet Hyakutake will spur scientists to go back and review measurements of other comets to see if unusual blips in their data contain hints of ethane. "For example, we're going to go back and look at Comet Halley data again," Mumma said. Similar measurements of Comet Hale-Bopp, which will pass closely by Earth in March and April 1997, are scheduled for June, he added.

As a comparison to comets, there are three major categories of asteroids. Some of the rocky bodies now considered to be asteroids may in fact be dead nuclei of short-period comets.

Both ethane and methane occur naturally on Earth and some other planets, and in certain meteorites, including the Murchison meteorite that fell on Australia in September 1969. While ethane is much less common than

methane in the planets, it is almost equally abundant to methane in both Comet Hyakutake and in the Murchison meteorite, the researchers note. "Therefore, it is possible that the gases found in the Murchison meteorite and those found in the comet had a common origin," according to Dr. Marina Fomenkova of the University of California at San Diego. "However, the diversity of organic material in primitive meteorites and in comets shows that they formed under a wide range of conditions," she cautions.

Science team members including Drs. Karen Magee-Sauer, Rowan College of New Jersey, Neil Dello Russo and David X. Xie of the Goddard Space Flight Center, and Charles Kaminski of the NASA Infrared Telescope Facility office, Hilo, Hawáii, are continuing to investigate the questions raised by the cometary ethane discovery.

"This is the type of finding that makes a person excited to be a planetary scientist," Mumma said. "It may open a new window on our understanding of comets and their role in shaping the world in which we live."

-end-

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For Release

May 31, 1996

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RELEASE: 96-109

COMMANDER, PILOT, FLIGHT ENGINEER ROUND OUT STS-83 CREW

Jim Halsell (Lt. Colonel, USAF) will command the long-duration Microgravity Science Laboratory mission set for launch on board Columbia in the spring of 1997. Halsell will be joined on the flight deck by pilot Susan Still (Lieutenant, USN) the first of the 1995 class of astronauts to be assigned to a Space Shuttle flight, and Mission Specialist Mike Gernhardt, Ph.D.

They join Payload Commander Janice Voss and Mission Specialist Don Thomas previously named to the flight, along with Payload Specialists Roger K. Crouch and Gregory T. Linteris.

Halsell, 39, has flown twice on the Space Shuttle, as pilot on Columbia during the STS-65 mission in July 1994 and on Atlantis for STS-74, the second Shuttle-Mir docking mission. Still, 34, will be making her first space flight on STS-83 following the successful completion of more than one year of training to prepare her for assignment to Shuttle flights.

Gernhardt, 40, will be making his second journey into space having flown previously on Endeavour during STS-69, the second flight of the Wake Shield Facility.

The 16-day Spacelab mission will feature more than 25 microgravity science investigations in fluid physics, combustion science and materials science.

For complete biographical information on the STS-83 crew and other astronauts, see the NASA Internet astronaut biography home page at URL: http://www.jsc.nasa.gov/Bios/

- end -

News Release

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For Release

May 31, 1996

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RELEASE: 96-110

NASA ROBOT MAY ENHANCE BRAIN SURGERY

A simple robot that can "learn" the physical characteristics of the brain soon may give surgeons finer control of surgical instruments during delicate brain operations.

In a new procedure being developed at NASA's Ames Research Center, Mountain View, CA, a robotic probe will "learn" the brain's characteristics by using neural net software, which is the same type of software technology that helps focus camcorders. The probe, equipped with a tiny pressure sensor, will enter the brain, gently locating the edges of tumors while preventing damage to critical arteries.

"Potentially, the robot will be able to 'feel' brain structures better than any human surgeon, making slow, very precise movements during an operation," said principal investigator Dr. Robert W. Mah of the NeuroEngineering Group at Ames. Brain tumors typically have a different density than normal brain tissue. This difference allows neurosurgeons to find the tumor's edge through experience.

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"NASA's Neurosurgical Computational Medicine Testbed is a unique and essential element in our goal to improve the safety, accuracy and efficiency of neurosurgery," said Dr. Russell J. Andrews of the Veterans Affairs Palo Alto Health Care System and clinical associate professor of neurosurgery at Stanford University. "This collaboration is a good start toward meeting that goal." Mah has worked with Andrews since 1994 to develop the smart robot.

The probes used on the robot are much smaller than standard probes, and should further reduce potential brain damage. During standard brain surgery, the surgeon uses a magnetic resonance image to guide placement of the probe in the brain. The physician samples the tumor by inserting a biopsy probe through an opening in the skull.

"A probe can be as large as 0.2 inches in diameter," Mah said. "As it enters the brain, there may be injury to brain tissue. If an artery is damaged as the doctor inserts the probe, the patient could bleed to death," Mah said.

In contrast, during the robotic neural net procedure, the speed and maximum pressure are controlled by a "smart" computer program that continues to learn as it gains more experience. If it hits an artery, the probe will stop before it penetrates. If the computer stops the probe, the surgeon can decide what to do next.

"Besides having robotic computer control, we have miniaturized everything. Instead of a probe that is almost 0.2 inches in diameter, all we need is a probe about one-third that size," Mah said. "That minimizes brain damage, too." A biopsy needle extracts a tissue sample through the probe.

Ames is developing robotic telepresence surgery to deal with medical emergencies that may occur during long-duration human space flights. "On a long-duration mission, there likely won't be a medical specialist on board to deal with a specific surgical problem," Mah said. "A surgeon on Earth could control the surgery by issuing high-level commands, such as 'start surgery' or 'take sample' to the robot. The computerized robot would go as far as it could within safe limits. Then it would wait for the next command from Earth."

During early tests, scientists used tofu, a food made from soybeans that has a consistency very similar to brain tissue, to model tissue types. "These tests were used to teach the neural net software what are normal brain tissues and arteries and what are not," Mah said.

The software learns to distinguish tumors from normal brain tissue by remembering the pressure signatures or profiles for each kind of tissue, and then making a model. Using traditional computer programming to do the brain modeling job is not practical. "It is very difficult to model the human brain. A human computer programmer would have to mathematically model each patient and each kind of tissue," Mah added.

A modified form of the brain surgery robot could be used for other kinds of surgery. "It could be used in the kinds of surgery that can use 'smart' sensors. Besides pressure sensors, there are sensors that can detect temperature, acidity and the amounts of various kinds of chemicals," he said.

In addition to the brain surgery project, the Ames NeuroEngineering Laboratory is developing other forms of software with potential uses such as balancing the centrifuge on the International Space Station, balancing airborne astronomical telescopes, emergency aircraft propulsion control and eliminating atmospheric distortion from astronomical telescopes.

-end-

Images of the robot are available on the Internet via the Ames Public Affairs Home Page. The URL is:

http://ccf.arc.nasa.gov/dx

News Release

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For Release
May 31, 1996

RELEASE: 96-111

SAFETY PANEL TO CONDUCT SPACE SHUTTLE PROGRAM REVIEW

NASA has asked the Aerospace Safety Advisory Panel to undertake a focused review of the Space Shuttle program, concentrating on the safety of the Shuttle in light of management changes, planned Shuttle upgrades and flight rates to build and support the International Space Station. The safety review is being conducted at the request of the White House.

The ASAP was created by the Congress in 1967 following a command module fire on Apollo 204. The panel will submit their final report through NASA to the White House by the end of November.

"We welcome this review," said Steve Oswald, the Office of Space Flight's deputy associate administrator (Shuttle). "Our number one priority in the Shuttle program is to fly safely, and we welcome the ASAP's experienced and independent viewpoint to make sure we stay focused on that goal."

In directing the NASA Administrator to conduct the review, the President's Science Advisor Dr. John H. Gibbons stated as its goal, "to ensure that our efforts to improve and streamline the Space Shuttle program do not inadvertently create unacceptable risk."

The Shuttle program has been at the forefront of the Agency's efforts to reshape its management and organizational structure. Changes in the Shuttle program include plans to consolidate Shuttle operations to a single prime contractor, downsizing the Shuttle workforce, and reducing the cost of operations and management.

"We've accomplished these changes while successfully maintaining the safety and reliability of the system," said Oswald. "What we want the Safety Panel to do is examine all the things we have done, or plan to do, and make sure we are not overlooking anything that could adversely affect safety."

Oswald said NASA also will ask the Safety Panel to examine the planned Shuttle flight rate, and conduct a technical audit of the performance improvements planned for the Shuttle in preparation for constructing and supporting the International Space Station.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

June 3, 1996

Edward Campion
Headquarters, Washington, DC
(Phone: 202/358-1780)

Rob Navias
Johnson Space Center, Houston, TX
(Phone: 713/483-5111)

NOTE TO EDITORS: N96-36

BRIEFINGS SET FOR LIFE AND MICROGRAVITY RESEARCH FLIGHT

The objectives of the 78th Space Shuttle flight will be discussed in a series of briefings to be held June 11 at the Johnson Space Center, Houston, TX and the Marshall Space Flight Center, Huntsville, AL.

Seven astronauts, including a French and a Canadian researcher, are scheduled to be launched on June 20 aboard the Shuttle Columbia, designated STS-78/LMS-1 (Life and Microgravity Sciences-1). The mission is a 16-day flight in which life and microgravity sciences experiments will be conducted in a Spacelab module housed in Columbia's cargo bay.

The flight may be extended to 17 days to gather additional scientific data if electrical power permits. A decision on extending the flight will not be made until at least the 11th day of the mission.

Briefings will begin at 9 a.m. EDT at Johnson with the mission overview briefing provided by STS-78 Lead Flight Director John Shannon. At 10 a.m., briefings will switch to Marshall for an LMS-1 science overview. Briefings will conclude at 2:30 p.m. EDT at Johnson with the crew news conference.

All briefings will be transmitted on NASA Television with two-way question and answer capability from participating NASA centers.

Following is the briefing schedule (all times are EDT):

-more-

June 11, 1996

9 a.m. STS-78 Mission Overview (originating from Johnson)
John Shannon, Lead Flight Director

10 a.m. LMS-1 Science Overview (originating from Marshall)
Mark Boudreaux, LMS-1 Mission Manager
Dr. Patton Downey, LMS-1 Mission Scientist
Dr. Victor Schneider, LMS-1 Program Scientist
Brad Carpenter, LMS-1 Microgravity Program Scientist

Noon NASA-TV Video File

2:30 p.m. Crew News Conference (originating from Johnson)
Tom Henricks, Commander
Kevin Kregel, Pilot
Rick Linnehan, Mission Specialist 1
Susan Helms, Mission Specialist 2, Payload Commander
Chuck Brady, Mission Specialist 3
Jean-Jacques Favier, Payload Specialist 1
Robert Thirsk, Payload Specialist 2

NASA Television is located on Spacenet 2, Transponder 5, Channel 9 at 69 degrees West longitude. The transponder frequency is 3880 Mhz and audio is 6.8 Mhz. Polarization is horizontal.

-end-

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News Release

National Aeronautics and
Space Administration

Washington, DC 20546
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For Release

June 3, 1996

James Cast
Headquarters, Washington, DC
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David Drachlis
Marshall Space Flight Center, Huntsville, AL
(Phone: 205/544-0034)

NOTE TO EDITORS: N96-37

SECOND AND POSSIBLE THIRD FLIGHT OF DELTA CLIPPER SET FOR JUNE 7

The second in a series of five test flights planned for NASA's Delta Clipper-Experimental Advanced (DC-XA) single-stage rocket is scheduled for10 a.m. EDT on Friday, June 7 at the White Sands Missile Range, New Mexico. If conditions permit, a third flight of the DC-XA may be attempted, possibly as early as eight hours after completion of the second flight in the test series. A decision to attempt that additional flight will be made about four hours after completion of the scheduled second test.

The DC-XA, developed by McDonnell Douglas Aerospace and NASA under a cooperative agreement as part of the Reusable Launch Vehicle Technology Program, successfully completed its first test flight on May 18.

Media representatives may cover the tests by requesting accreditation from the White Sands Missile Range Public Affairs Office by either facsimile (505/678-7174) or calling (505/678-1134). Media representatives already accredited must still register in advance to ensure adequate transportation to the test site. Media planning to view the test flight must be at Bldg. 122 by 7:30 a.m. EDT on flight day.

On Thursday, June 6, media will have an opportunity to photograph the DC-XA on its launch pad and interview program managers. Media wishing to participate in this event must report to the Public Affairs Office, Bldg. 122, by 2:45 p.m. EDT.

At 7 p.m. EDT June 6, a pre-flight briefing will be held in the San Rafael Room of the Hilton Hotel in Las Cruces, New Mexico. Officials from NASA, McDonnell Douglas Aerospace, the U.S. Air Force Phillips Laboratory, and White Sands Missile Range will participate.

-more-

The DC-XA flight will be carried live on NASA Television beginning at approximately 9:30 a.m. EDT. A post-flight media briefing will air approximately 30 minutes after the flight.

NASA Television is carried on C-band, Spacenet 2, Transponder 5, Channel 9 at 69 degrees west longitude. The transponder frequency is 3880 Mhz and the audio subcarrier is 6.8 Mhz.

-end-

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Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Kathryn Cataldo
Marshall Space Flight Center, Huntsville, AL
(Phone: 505/524-0331)

June 4, 1996

NEW BREED OF ROCKET TO BE TESTED FRIDAY JUNE 7, LIVE INTERVIEWS AVAILABLE FROM WHITE SANDS

At approximately 8 a.m. MDT and 4 p.m. MDT Friday June 7, a futuristic rocket that takes-off and lands vertically is scheduled to make its second and third test flights at the White Sands Missile Range in New Mexico. The Delta Clipper Experimental Aircraft (DC-XA) is evaluating technology that could lead to the development of a single-stage reusable launch vehicle. The experiment could launch a more efficient, cost effective way of getting to space.

Following each scheduled launch NASA will offer live interviews via satellite from White Sands. NASA officials will be available from 11 a.m. to 1 p.m. MDT, and from 3:30 pm to 4:30 p.m. MDT on June 7 to talk about this unique experiment. B-Roll of launch and preparations will be available in conjunction with the live interviews.

NASA will begin live coverage of this event at 7:15 a.m. MDT and continue throughout the day. Both the live coverage, B-roll and interviews can be found on KU-BAND, SBS-6, Transponder 12. Test preparations and the launch along with press briefings following the launch also may be received from C-Band, Spacenet 2, Transponder 5, Channel 9.

To book an interview please contact Kathryn Cataldo or Connie James at the Las Cruces La Quinta (505) 524-0331 or via cell phone by dialing (505) 644-7626, then (205) 651-5006.

- end -

Video Advisory

National Aeronautics and
Space Administration
Washington, DC 20546
(202) 358-1600

For Release

Deanna Corridon
Headquarters, Washington, DC
(Phone: 202/358-1733)

June 4, 1996

VIDEO ADVISORY: V96-66

TETHERED SATELLITE INVESTIGATION FOOTAGE ON NTV TUESDAY

On Tuesday NASA TV will televise file footage from the STS-75 mission, and animation showing deployment and subsequent loss of the Tethered Satellite. NASA will hold a Satellite Investigation Press Conference June 4, 1996, at 2:00 p.m. EDT.

ITEM #1: TETHERED SATELLITE INVESTIGATION
B-roll from the STS-75 mission showing deployment and loss of the satellite.

ITEM #2: TETHERED SATELLITE ANIMATION
Animation depicting deployment and loss of the satellite.

Video news files will air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
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For Release

June 4, 1996

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Headquarters, Washington, DC
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Enzo Letico
ASI, Washington, DC
(Phone: 202/863-1298)

RELEASE: 96-112

TETHERED SATELLITE INVESTIGATION REPORT IS RELEASED

NASA and the Italian Space Agency (ASI) today released the report of the investigative board appointed to determine factors which resulted in the Feb. 25 tether break and loss of the Tethered Satellite during the STS-75 Space Shuttle mission.

Findings of the board, included in a 358-page document, identified primary causes which accounted for the tether break during deployment of the Tethered Satellite.

"The tether failed as a result of arcing and burning of the tether, leading to a tensile failure after a significant portion of the tether had burned away," the report concludes. The arcing occurred because either external foreign object penetration (but not orbital debris or micrometeoroids) or a defect in the tether caused a breach in the layer of insulation surrounding the tether conductor. The insulation breach provided a path for the current to jump, or arc, from the copper wire in the tether to a nearby electrical ground.

The board found that the arcing burned away most of the tether material at that location, leading to separation of the tether from tensile or pulling force. The break occurred when approximately 12.2 miles (19.7 km) of tether was unreeled, in a period when the tether was experiencing normal stresses of approximately 15 pounds (65 newtons).

-more-

In addition to the two primary causes for the tether break, the board cited, as one contributing factor, that "the degree of vulnerability of the tether insulation to damage was not fully appreciated." The board noted that the actual environment that the tether was exposed to in flight made it more vulnerable to damage than was expected. And, it noted that the high voltages under which the system was operating could, over a period of time, have reduced the ability of the tether insulation to withstand electrical breakdown due to contamination found in the tether.

"The tether itself was a remarkable engineering achievement," said Ken Szalai, who chaired the investigative board, "and produced some startling scientific discoveries." Scientific papers recently presented at an American Geophysical Union conference reported that currents generated by the tether were three times higher than theoretical models had predicted prior to the flight.

"Constructing a tether that was strong, lightweight and electrically conducting took the project into technical and engineering areas where they had never been before," said Szalai. "Now, with 20/20 hindsight, they know where the system is vulnerable and can improve the design."

The Tethered Satellite System is a joint NASA-ASI system that was flown aboard Space Shuttle Columbia in an experiment to better understand the electrically charged environment of Earth's ionosphere, and how tether systems behave in it. ASI had the responsibility of providing the satellite, while NASA had the responsibility of the Deployer, which includes the tether, and the overall responsibility for payload integration and operations. The provision of science investigations was shared by ASI and NASA.

The system was generating 3,500 volts DC and up to 0.5 amps of current during satellite deployment. That high level of electrical energy resulted from the length of conducting tether extending from the Shuttle, coupled with the 17,500-mile-per-hour speed at which the Shuttle and tether were cutting through Earth's magnetic field lines.

The board found sufficient evidence to identify two possible causes of the breach in the insulation -- foreign object damage, or a defect in the tether itself. Debris and contamination found in the deployer mechanisms and in the tether itself could have been pushed into the insulation layer while the tether was still wound on its reel. The investigation found evidence of damage to copper wire in the tether, and also established that normal forces on the tether while on the reel could push a single copper strand or foreign debris through the insulation.

The arcing, which began in an intricate part of the Tethered Satellite System known as the lower tether control mechanism, sputtered intermittently for nine seconds as the moving tether passed through deployer mechanisms and then into the boom area of the tether system. At the time, tether was continuing to play out at one meter per second, or slightly more than three feet per second.

"This arcing produced significant burning of most of the tether material in the area of the arc," the board found. The tether was designed to carry up to 15,000 volts DC and handle tensile forces of up to 400 pounds (1780 newtons). It used super-strong strands of Kevlar as a strength-providing member, wound around the copper and insulation. However, postflight inspection of the tether end which remained aboard Columbia showed it to be charred. The board concluded that after arcing had burned through most of the Kevlar, the few remaining strands were not enough to withstand forces being exerted by satellite deployment.

Extensive, rigorous tests performed in support of the investigation established that undamaged tether would not arc, even when subjected to electrical potentials much higher than the 3500 volts experienced during the mission.

The board was able to exonerate a number of factors which clearly did not cause the break. These factors include the satellite, the science equipment hardware and operations, which were being conducted prior to the break, in addition to micrometeoroids or orbital debris impact, and electrical storm activity.

The investigation panel made several detailed recommendations which it said should be followed for any future space missions involving electrodynamic tether systems such as that flown aboard Columbia. These include more precautions to ensure any such tether systems in the future do not suffer from possible debris or contamination damage and specific attention during design to minimize the possibility of high-voltage arcing.

The board offered, in the form of observations, its assessment that the STS-75 tether problem "is not indicative of any fundamental problem in using electrodynamic tethers." It also noted that in spite of the break, a "significant amount" of scientific data was obtained from the Tethered Satellite operations during STS-75.

The nine-member independent review panel was formed in consultation with ASI and appointed by NASA's Associate Administrator for the Office of Space Flight, Wilbur Trafton, shortly after the tether break. The board was chaired by Ken Szalai, director of the Dryden Flight Research Center, Edwards, CA, and included representation from NASA and the ASI.

-end-

News Release

National Aeronautics and
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Washington, DC 20546
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For Release

June 5, 1996

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Eileen Hawley
Johnson Space Center, Houston, TX
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RELEASE: 96-113

ASTRONAUT KATHY THORNTON TO LEAVE NASA

Veteran astronaut Kathryn C. Thornton will leave NASA on August 1 to join the faculty of the University of Virginia.

Thornton, 43, has over 950 hours in space, including more than 21 hours of extravehicular experience. Thornton joins the faculty as a professor in the School of Engineering and Applied Sciences and also will serve as director of the Center for Science Education.

"We will certainly miss Kathy's experience and skills," said David C. Leestma, director of Flight Crew Operations. "We wish her the best in her new career."

For complete biographical information on Thornton and other astronauts, see the NASA Internet biography home page at URL:
http://www.jsc.nasa.gov/Bios/

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

June 6, 1996

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Franklin O'Donnell
Jet Propulsion Laboratory, Pasadena, CA
(Phone: 818/354-5011)

RELEASE: I96-5

INTERNET IMAGE SHOWS GALILEO ON TRACK

NASA's Galileo spacecraft, currently in orbit around Jupiter, has sent to Earth an optical navigation image that shows the spacecraft is on track for its June 27 close flyby of Jupiter's moon Ganymede.

The low-resolution navigation image, one of several that the spacecraft will take to help fine-tune its flight path as it approaches Ganymede, is available on the Internet at the following URL:

http://www.jpl.nasa.gov/releases/glopnav.html
http://www.jpl.nasa.gov/galileo

The series of images, used for navigation purposes only, are the product of new computer processing capabilites on the spacecraft that allow Galileo to send back the information required to show the spacecraft is properly targeted and that Ganymede is where navigators calculate it to be.

"This navigation image is totally different from the pictures we'll be taking for scientific study of Ganymede when we get close to it later this month," said Galileo Project Scientist Dr. Torrence Johnson. On June 27, Galileo will fly just 524 miles (844 kilometers) above Ganymede and return the most detailed, full-frame, high-resolution images and other measurements of the satellite ever obtained. These Ganymede images are expected to be available by mid-July.

- end -

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News Release

National Aeronautics and
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For Release

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June 6, 1996

NOTE TO EDITORS: N96-38

NASA SETS JUNE 20 AS LAUNCH DATE FOR MISSION STS-78

At the conclusion of a flight readiness review meeting today, NASA managers set June 20, 1996, as the official launch date for the agency's next Space Shuttle mission - designated STS-78. NASA's fifth Shuttle mission of 1996 will involve Shuttle Columbia and a seven-person crew working with the Life and Microgravity Sciences (LMS) payload being carried in the pressurized Spacelab module in the Shuttle's cargo bay. The LMS payload consists of various experiments designed to examine how human beings and other living organisms along with various materials change in a weightless environment.

Launch of Columbia on June 20 is scheduled for 10:49 a.m. EDT at the opening of a 2 1/2 hour available launch window. The STS-78 mission duration is currently planned for 15 days, 22 hours, 20 minutes. However, Mission Control will be carefully managing and monitoring Columbia's electrical power comsumption with an eye towards extending the flight one day so additional science work can be performed. If the extension day happens, the mission duration would become 16 days, 22 hours, 2 minutes thus making the STS-78 flight NASA's longest Shuttle mission to date. An on-time launch and one day mission extension would set Columbia up for a landing on July 7 at 8:51 a.m. EDT at the Kennedy Space Center.

The STS-78 crew will be commanded by Terence "Tom" T. Henricks. The pilot for the mission is Kevin R. Kregel. The three mission specialists assigned to the flight are Richard M. Linnehan, Susan J. Helms, who is also the STS-78 Payload Commander, and Charles E. Brady. There also are two payload specialists serving as part of the STS-78/LMS crew--Jean-Jacques Favier from the French Atomic Energy Commission (CEA) and an astronaut of the French Space Agency (CNES), and Robert Brent Thirsk from the Canadian Space Agency (CSA).

STS-78 will be the 20th flight of Columbia and the 78th mission flown since the start of the Space Shuttle program in April 1981.

-end-

Video Advisory

National Aeronautics and
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Washington, DC 20546
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Deanna Corridon
Headquarters, Washington, DC
(Phone: 202/358-1733)

For Release

June 6, 1996

VIDEO ADVISORY: V96-67

SIGNATURES FLY TO SATURN; DC-XA FOOTAGE ON NTV THURSDAY

On Thursday NASA TV will televise footage of volunteer workers at The Planetary Society, Pasadena, CA, scanning signatures sent from people around the world which will be carried aboard the Cassini spacecraft once it begins it's mission to Saturn. Cassini will be the first spacecraft to utilize digital technology enabling over a million people's signatures to be scanned on a disc. Also on NASA TV, will be file footage showing the first flight of NASA's Delta Clipper-Experimental Advanced (DC-XA) reusable flight vehicle on May 18, 1996. Television coverage of the second flight of DC-XA is scheduled to begin at 11:15 a.m. EDT on June 7, 1996.

ITEM #1: YOUR NAME ON SATURN
Signatures from around the world will be taken to Saturn by the Cassini spacecraft.

ITEM #2: ROLL CALL
Volunteers at the Planetary Society scan signatures that will be carried aboard Cassini.

ITEM #3: INTERVIEW - DAVE HAGLE, VOLUNTEER COORDINATOR, PLANETARY SOCIETY
Discusses promoting the public's involvement with The Planetary Society through the Cassini Project. *For more information contact Douglas Isbell at (202) 358-1753.*

ITEM #4: DC-XA B-ROLL
B-roll of the first test flight of the DC-XA on May 18, 1996. *For more information contact James Cast at (505) 678-1134.*

Video news files will air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Deanna Corridon
Headquarters, Washington, DC
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June 7, 1996

VIDEO ADVISORY: V96-68

SECOND FLIGHT OF DC-XA ON NTV FRIDAY

On Friday, June 7, 1996, NASA TV will televise the second test flight of the Delta Clipper-Experimental Advanced (DC-XA) single-stage rocket from White Sands Missile Range, NM. The experimental technology used to develop DC-XA could be used to launch a more efficient, cost effective way to access space. If conditions permit, another flight of the DC-XA may be attempted later in the day.

NASA TV also will replay file footage and interviews from the first flight of DC-XA that took place on May 18, 1996.

11:15 a.m. EDT - DC-XA Second Flight Television Coverage - White Sands
Noon EDT - DC-XA Launch - White Sands
1 p.m. EDT - DC-XA Post Launch Press Conference - White Sands

*****Note: Approximate Times**

For more information contact James Cast at (505) 678-1134.

Video news files will air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
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For Release

James Cast
Headquarters, Washington, DC
(Phone: 202/358-1779)

June 7, 1996

RELEASE: 96-114

REVOLUTIONARY NEW LAUNCH VEHICLE RENAMED FOR SPACE PIONEER

NASA Administrator Daniel S. Goldin today announced that the Agency's experimental DC-XA flight vehicle -- a vertical takeoff and landing rocket ship -- will be re-named "Clipper Graham" in honor of the late Lt. General Daniel O. Graham.

"NASA is committed to developing and demonstrating reusable launch vehicle technologies. Graham was a visionary who championed the promise of fully reusable single-stage-to-orbit vehicles at a time when the majority of the space community were skeptics. We're doing this in commemoration of his vision in opening the space frontier," Goldin said.

Formerly called the Delta Clipper, the four-story DC-XA is currently conducting a series of unmanned flight tests in New Mexico for NASA. The project was conceived to provide NASA's Reusable Launch Vehicle Program with an early, small scale flight demonstration of advanced technologies required by reusable launch vehicles. The DC-XA, developed by the Department of Defense, incorporates the latest advances in technology, propulsion systems and composite materials.

A West Point graduate, Graham served in a number of high military and government posts including Deputy Director of the Central Intelligence Agency and Director of the Defense Intelligence Agency. He also founded and became Chairman of the Space Transportation Association to assure continued U.S. leadership and superiority in providing reliable, economical space transportation systems.

- end -

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News Release

National Aeronautics and
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Washington, DC 20546
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For Release

June 10, 1996

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Headquarters, Washington, DC
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Tammy Jones
Goddard Space Flight Center, Greenbelt, MD
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Ray Villard
Space Telescope Science Institute, Baltimore, MD
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NOTE TO EDITORS: N96-39

NEW HUBBLE IMAGES OF DOOMED STAR ETA CARINAE AVAILABLE; INTERNET USERS CAN VIEW IMAGE IN 3-D

A huge, billowing pair of gas and dust clouds are captured in stunning new Hubble Space Telescope (HST) images of one of the most massive stars in our Galaxy, the supermassive Eta Carinae. Eta Carinae, located more than 8,000 light years away, was the site of a giant outburst about 150 years ago, when it became one of the brightest stars in the southern sky. A combination of image processing techniques reveal astonishing detail of the exploding star, which is radiating about five million times more power than our Sun.

Those with Internet access can view a unique 3-D (three-dimensional) image of the exploding star, which was assembled from two HST images of Eta Carinae take 17 months apart (April 1994 and September 1995). Hubble's high resolution of the motion of the gas and dust between the observations allowed astronomers to combine and encode the images to reveal the true three-dimensional geometry of the system. To see the 3-D structure, the image must be viewed through color 3-D glasses with the left eye looking through a red filtered lens, and right eye looking through a blue filtered lens. Please note 3D glasses will not be available through NASA or the Space Telescope Science Institute.

All the image files (including the 3-D image) in GIF and JPEG format, as well as captions may be accessed on Internet via anonymous ftp from ftp.stsci.edu in /pubinfo.

- more -

	GIF	JPEG
Eta Carinae color	gif/EtaCarC.gif	jpeg/EtaCarC.jpg
Eta Carinae diff.	gif/EtaCarD.gif	jpeg/EtaCarD.jpg
Eta Carinae 3-D	gif/EtaCarS.gif	jpeg/EtaCarS.jpg

GIF and JPEG images, captions and information are available via World Wide Web at:
http://www.stsci.edu/pubinfo/PR/96/23.html and via links in:
http://www.stsci.edu/pubinfo/latest.html or
http://www.stsci.edu/pubinfo/pictures.html.

Hard copy prints of the images (except the 3-D image) are available to news media representatives by calling 202/358-1900. Photo numbers are:

	Color	B & W
Super-Sharp View	96-HC-361	96-H-361
Expansion of Debris	- - -	96-H-362

- end -

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
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For Release

June 10, 1996

Deanna Corridon
Headquarters, Washington, DC
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VIDEO ADVISORY: V96-69

NASA'S HUBBLE SPACE TELESCOPE CAPTURES EXPLODING STAR; CLIPPER GRAHAM ON NTV MONDAY

On Monday NASA TV will televise an image captured by NASA's Hubble Space Telescope of a pair of huge surging gas and dust clouds--the aftermath of a dying star. The star called Eta Carinae exploded about 150 years ago, becoming one of the brightest stars in the Southern sky. NASA TV also will replay the second successful test flight of the Clipper Graham single-stage rocket, on Friday, June 7, 1996, from the White Sands Missile Range, NM. A third, in a series of test flights may be shown if attempted on Friday.

ITEM #1: A STAR IS DOOMED
Image of the supermassive star Eta Carinae taken by NASA's Hubble Space Telescope.

For more information contact Don Savage at (202) 358-1727.

ITEM #2: DELTA CLIPPER 2ND/3RD FLIGHT
Clipper Graham completes its second successful test flight. Note: A third test flight may be shown if attempted late in the evening on Friday, June 7, 1996.

For more information contact James Cast at (505) 678-1134.

Video news files will air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

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For Release

Jim Cast
Headquarters, Washington, DC
(Phone: 202/358-1779)

June 10, 1996

Jerry Berg
Marshall Space Flight Center, Huntsville, AL
(Phone: 205/544-0034)

RELEASE: 96-115

X-34 CONTRACTOR SELECTED FOR NEGOTIATIONS

NASA has selected Orbital Sciences Corp., Dulles, VA, for final negotiations leading to the award of a contract to build a small, reusable technology demonstrator vehicle, known as the X-34 demonstrator, and begin flight testing it in late summer of 1998.

The contract includes the first two X-34 flight tests and covers a program valued at approximately $60 million.

The fast-track X-34 program calls for demonstrating a vehicle that will be capable of flying up to 25 times a year at a cost of $500,000 or less per flight, attaining altitudes of at least 250,000 feet, and flying at speeds of up to eight times the speed of sound. Other specifications for the vehicle include use of advanced thermal protection systems and demonstration of the ability to fly subsonically through rain and fog.

Flights of the X-34 will involve testing of new technologies such as composite material structures, composite tanks and new, integrated avionics, as well as demonstrations of safe abort and autonomous landing techniques, in high cross winds, using advanced landing systems. The selection of Orbital Sciences for negotiations follows issuance of a NASA Research Announcement in March 1996, which restructured the X-34 program.

The current program puts primary emphasis on demonstrating key technologies for a small, reusable vehicle, not tied to potential commercial applications. The X-34 effort is part of NASA's Reusable Launch Vehicle (RLV) technology program, aimed at reducing the cost of access to space, and promoting the creation and delivery of new space services and other activities that will improve U.S. economic competitiveness.

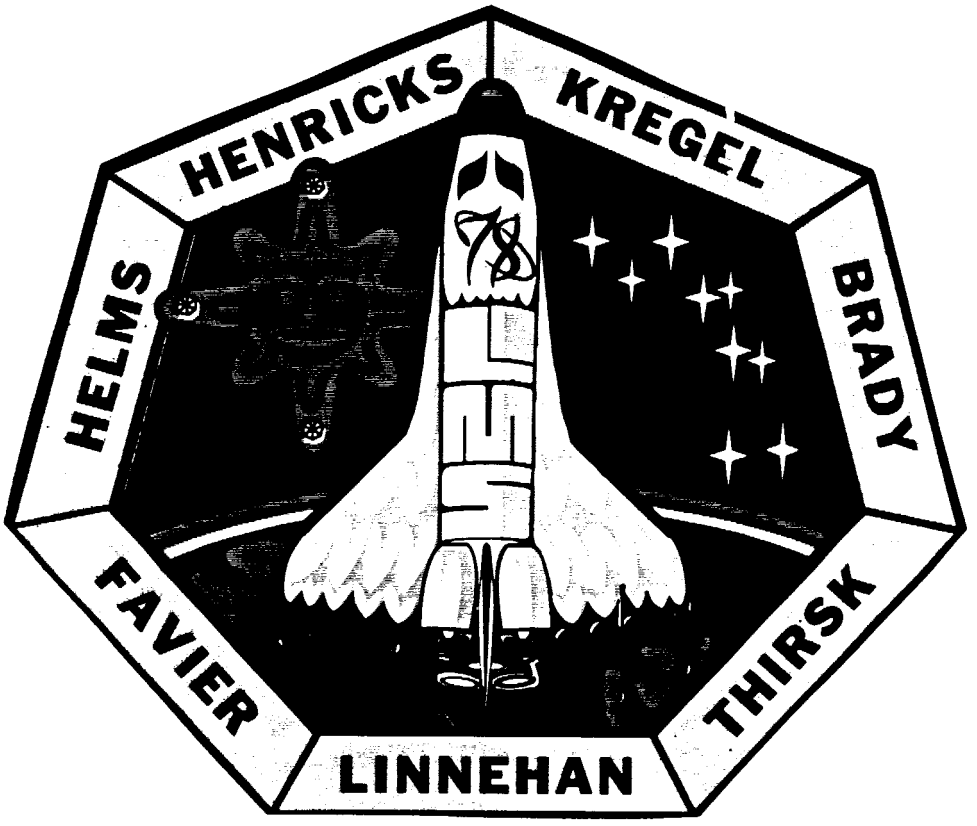
-end-

96-116

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SPACE SHUTTLE MISSION STS-78

PRESS KIT
JUNE 1996



Life and Microgravity Spacelab

For Information on the Space Shuttle

Ed Campion Headquarters, Washington, DC	Policy/Management	202/358-1778
Rob Navias Johnson Space Center, Houston, TX	Mission Operations Astronauts	713/483-5111
Bruce Buckingham Kennedy Space Center, FL	Launch Processing KSC Landing Information	407/867-2468
June Malone Marshall Space Flight Center, Huntsville, AL	External Tank/Shuttle Propulsion	205/544-0034
Cam Martin Dryden Flight Research Center, Edwards, CA	DFRC Landing Information	805/258-3448

STS-78 Experiments & Activities

Mike Braukus Headquarters, Washington, DC	LMS	202/358-1979

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GENERAL BACKGROUND

Cargo Bay Payloads

Crew Biographies

RELEASE: 96-116

LIFE AND MICROGRAVITY SCIENCES RESEARCH
HIGHLIGHT SHUTTLE MISSION STS-78

The flight of Space Shuttle Columbia on Mission STS-78 will utilize an orbiting research laboratory to conduct a diverse slate of experiments on how human beings and other living organisms along with various materials change in a weightless environment.

Launch of Columbia is currently targeted for June 20, 1996 at 10:49 a.m. EDT from Kennedy Space Center's Launch Complex 39-B. The STS-78 mission duration is currently planned for 15 days, 22 hours, 20 minutes. However, Mission Control will be carefully managing and monitoring Columbia's electrical power consumption with an eye towards extending the flight one day so additional science work can be performed. If the extension day happens, the mission duration would become 16 days, 22 hours, 2 minutes and would make the STS-78 flight NASA's longest Shuttle mission to date. An on-time launch and one day mission extension would set Columbia up for a landing on July 7th at 8:51 a.m. EDT at Kennedy Space Center.

The STS-78 crew will be commanded by Terence T. "Tom" Henricks, making his fourth Shuttle flight. Payload Commander and Mission Specialist-2 Susan
J. Helms, is making her third flight. The pilot for the mission, Kevin R. Kregel, is making his second flight. There are two other mission specialists assigned to the flight. Richard M. Linnehan, serving as Mission Specialist-1, is making his first flight. Charles E. Brady, serving as Mission Specialist-3, is making his first flight. There also are two payload specialists serving as part of the STS-78 crew. Jean-Jacques Favier from the French Atomic Energy Commission (CEA) and an astronaut of the French Space Agency (CNES) will serve as Payload Specialist-1. Robert Brent Thirsk from the Canadian Space Agency (CSA) will serve as Payload Specialist-2. Both Favier and Thirsk will be making their first space flight.

The flight will involve the Life and Microgravity Sciences (LMS) payload being carried in the pressurized Spacelab module in Columbia's cargo bay and will focus on two main areas. The LMS life science studies will probe the responses of living organisms to the low-gravity environment and highlight musculoskeletal physiology. LMS microgravity experiments will focus on understanding the subtle influences at work during processing of various samples, such as alloy materials, when gravity's effect is greatly reduced. On Earth, gravity distorts scientific results. Materials processed on orbit reveal underlying secrets masked or distorted in ground-based laboratories. Likewise, free from gravity, the human body undergoes changes that can affect astronaut performance. While LMS life sciences information will help prepare crews for longer duration missions, the causes of, and cures for, similar ailments experienced on Earth may be found.

The STS-78 crew also will take on the role of teachers as they educate students in the United States and other countries about their mission objectives. Using the Shuttle Amateur Radio Experiment-II, which is carried aboard the Shuttle on a regular basis, crewmembers will talk with students around the world about what it is like to live and work in space.

STS-78 will be the 20th flight of Columbia and the 78th mission flown since the start of the Space Shuttle program in April 1981.

- end of general release -

MEDIA SERVICES INFORMATION

NASA Television Transmission

NASA Television is available through the Spacenet-2 satellite system. Spacenet-2 is located on Transponder 5, at 69 degrees West longitude, frequency 3880.0 MHz, audio 6.8 MHz.

The schedule for television transmissions from the Orbiter and for mission briefings will be available during the mission at Kennedy Space Center, FL; Marshall Space Flight Center, Huntsville, AL; Dryden Flight Research Center, Edwards, CA; Johnson Space Center, Houston, TX; and NASA Headquarters, Washington, DC. The television schedule will be updated to reflect changes dictated by mission operations.

Television schedules also may be obtained by calling COMSTOR at 713/483-5817. COMSTOR is a computer data base service requiring the use of a telephone modem. A voice update of the television schedule is provided daily at noon Eastern time.

Television schedules also may be obtained via the Internet on:

http://www.hq.nasa.gov/office/pao/ntv.html

Status Reports

Status reports on countdown and mission progress, on-orbit activities and landing operations will be produced by the appropriate NASA newscenter.

Briefings

A mission press briefing schedule will be issued prior to launch. During the mission, status briefings by a flight director or mission operations representative and when appropriate, representatives from the payload team, will occur at least once each day. The updated NASA television schedule will indicate when mission briefings are planned.

Internet Information

Information on STS-78 is available through several sources on the Internet. The primary source for mission information is the NASA Shuttle Web, part of the World Wide Web. This site contains information on the crew and their mission and will be regularly updated with status reports, photos and video clips thoughout the flight. The NASA Shuttle Web's address is:
http://shuttle.nasa.gov

If that address is busy or unavailable, Shuttle information is available through the Office of Space Flight Home Page:
http://www.osf.hq.nasa.gov/

General information on NASA and its programs is available through the NASA Home Page and the NASA Public Affairs Home Page:
http://www.nasa.gov
http://www.gsfc.nasa.gov/hqpao/hqpao_home.html

Information on other current NASA activities is available through the Today@NASA page:
http://www.hq.nasa.gov/office/pao/NewsRoom/today.html

Status reports, TV schedules and other information is also available from the NASA Headquarters FTP server, **ftp.hq.nasa.gov**. Log in as anonymous and go to the directory /pub/pao. Users should log on with the user name "anonymous" (no quotes), then enter their E-mail address as the password. Within the /pub/pao directory there will be a "readme.txt" file explaining the directory structure.

NASA's Spacelink, a resource for educators, also provides mission information via the Internet. The system fully supports the following Internet services:

World Wide Web	**http://spacelink.msfc.nasa.gov**
Gopher	**spacelink.msfc.nasa.gov**
Anonymous FTP	**spacelink.msfc.nasa.gov**
Telnet	**spacelink.msfc.nasa.gov**

Spacelink's dial-up modem line is 205-895-0028.

Access by CompuServe

Users with CompuServe accounts can access NASA press releases by typing "GO NASA" (no quotes) and making a selection from the categories offered.

QUICK LOOK DATA

Launch Date/Site:	June 20, 1996/KSC Launch Pad 39-B
Launch Time:	10:49 AM EDT
Launch Window:	2 hours, 30 minutes
Orbiter:	Columbia (OV-102), 20th flight
Orbit Altitude/Inclination:	153 nautical miles, 39 degrees
Mission Duration:	15 days, 22 hours
Landing Date:	July 7, 1996
Landing Time:	8:49 AM EDT
Primary Landing Site:	Kennedy Space Center, FL
Abort Landing Sites:	Return to Launch Site - KSC Transoceanic Abort Sites - Ben Guerir, Morocco Moron, Spain Zaragoza, Spain Abort-Once Around - Edwards Air Force Base, CA
Crew:	Tom Henricks, Commander (CDR) Kevin Kregel, Pilot (PLT) Rick Linnehan, Mission Specialist 1 (MS 1) Susan Helms, Payload Cdr, Mission Specialist 2 (MS 2) Charles Brady, Mission Specialist 3 (MS 3) Jean-Jacques Favier, Payload Specialist 1 (PS 1) Robert Thirsk, Payload Specialist 2 (PS 2)
EVA Crew (if required):	Susan Helms (EV 1), Rick Linnehan (EV 2)
Cargo Bay Payloads:	LMS EDO Pallet
In-Cabin Payloads:	SAREX

Shuttle Abort Modes

Space Shuttle launch abort philosophy aims toward safe and intact recovery of the flight crew, Orbiter and its payload. Abort modes for STS-78 include:

- Abort-To-Orbit (ATO) -- Partial loss of main engine thrust late enough to permit reaching a minimal 105-nautical mile orbit with the orbital maneuvering system engines.

- Abort-Once-Around (AOA) -- Earlier main engine shutdown with the capability to allow one orbit of the Earth before landing at the Kennedy Space Center, FL.

- Transoceanic Abort Landing (TAL) -- Loss of one or more main engines midway through powered flight would force a landing at either Ben Guerir, Morocco; or Moron, Spain.

- Return-To-Launch-Site (RTLS) -- Early shutdown of one or more engines, and without enough energy to reach a TAL site, would result in a pitch around and thrust back toward Kennedy until within gliding distance of the Shuttle Landing Facility.

MISSION SUMMARY TIMELINE

Flight Day One:
Launch/Ascent
OMS-2 Burn
Spacelab Activation
LMS Operations

Flight Days 2-5:
LMS Operations

Flight Day 6:
LMS Operations
Off Duty Time

Flight Days 7-10:
LMS Operations

Flight Day 11:
LMS Operations
Off Duty Time
Crew News Conference

Flight Day 12-15:
LMS Operations

Flight Day 16:
LMS Operations
Flight Control System Checkout
Reaction Control System Hot-Fire
Spacelab Deactivation
Cabin Stowage

Flight Day 17:
Deorbit Prep
Deorbit Burn
KSC Landing

STS-78 ORBITAL EVENTS SUMMARY
(Based on a June 20, 1996 Launch)

EVENT	MET	TIME OF DAY (EDT)
Launch	0/00:00	10:49 AM, June 20
OMS-2	0/00:43	11:32 AM, June 20
Crew News Conference	9/23:50	10:39 AM, June 30
Deorbit Burn	15/21:00	7:49 AM, July 6
KSC Landing	15/22:00	8:49 AM, July 6

PAYLOAD AND VEHICLE WEIGHTS

Vehicle/Payload	Pounds
Orbiter (Columbia) empty and 3 SSME's	160,330
Shuttle System at SRB Ignition	4,517,152
Orbiter Weight at Landing with Cargo	256,170
Spacelab Module	21,272

CREW RESPONSIBILITIES

Payloads	Prime	Backup
Spacelab	Kregel, Henricks	Helms, Linnehan
LMS Experiments	Helms	
AGHF	Favier	Helms
BDPA	Favier	Helms
PGF	Helms	Favier
Other microgravity	Helms	Kregel
TVD experiments	Thirsk	Linnehan
ALFE	Linnehan	Thirsk
COIS	Thirsk	Helms
Metabolic	Brady	Linnehan
PAWS	Helms	Henricks
SACS	Thirsk	Brady
TRE	Thirsk	Brady
EVA	Helms (EV 1)	Linnehan
Intravehicular Crewmember	Kregel (EV2)	--------
SAREX	Brady	Helms
DTO's	Henricks	Kregel
DSO's	Henricks	Kregel
Earth Observations	Kregel	Henricks

DEVELOPMENTAL TEST OBJECTIVES/DETAILED SUPPLEMENTARY OBJECTIVES

DTO 301D: Ascent Structural Capability Evaluation
DTO 307D: Entry Structural Capability
DTO 312: ET TPS Performance
DTO 319D: Shuttle/Payload Low Frequency Environment
DTO 623: Cabin Air Monitoring
DTO 667: Portable In-Flight Landing Operations Trainer
DTO 675: Voice Control of Closed Circuit Television System
DTO 1126: KCA Video Teleconferencing Demonstration
DSO 487: Immunological Assessment of Crewmembers
DSO 491: Characterization of Microbial Transfer Among Crewmembers
DSO 493: Monitoring Latent Virus Reactivation and Shedding in Astronauts
DSO 802: Educational Activities
DSO 901: Documentary Television
DSO 902: Documentary Motion Picture Photography
DSO 903: Documentary Still Photography

SCIENCE ABOARD STS-78 --
THE LIFE AND MICROGRAVITY SPACELAB MISSION

The STS-78 crew will conduct a diverse slate of experiments divided into a mix of life science and microgravity investigations.

LMS life science studies will probe the responses of living organisms to the low-gravity environment of the Space Shuttle in orbit and highlight musculoskeletal physiology. LMS microgravity experiments will focus on understanding the subtle influences at work during processing of various samples, such as alloy materials, when gravity's effect is greatly reduced. On Earth, gravity distorts scientific results. Materials processed on orbit reveal underlying secrets masked or distorted in ground-based laboratories. Likewise, free from gravity, the human body undergoes changes that can affect astronaut performance. While LMS life sciences information will help prepare crews for longer duration missions as our role in space expands, the causes of, and cures for, similar ailments experienced on Earth also may be found.

In a manner very similar to future Space Station operations, LMS researchers from the United States and abroad will share resources such as crew time and equipment. Experiments for the mission were developed on a fast-track schedule -- about 21 months, versus 36 to 48 months for most Spacelab missions. This faster turnaround time from selection to flight also will hold true for many Space Station experiments. To develop effective countermeasures, the crew will perform various motor-skill tests and participate in measurements of bone and muscle density. These data will be supplemented and verified through ground-based studies and will be compared to data gathered before and after the flight.

LMS life science studies are divided into two fields -- human physiology and space biology. The five areas of human physiology are musculoskeletal, metabolic, pulmonary, human behavior and performance, and neuroscience. Three space biology experiments will study growth of pine saplings, development of fish embryos, and bone changes in laboratory rats.

Human Physiology Experiments

Four major space agencies sponsor the human physiology experiments that make up the Johnson Space Center Human Life Sciences Project. They are NASA, the European Space Agency (ESA), the French Space Agency (CNES) and the Canadian Space Agency (CSA). Since each complementary experiment studies a different body area, a well-rounded data base will be generated to help researchers understand how the body changes in low gravity so they can develop effective countermeasures.

Musculoskeletal Investigations -- Muscles that Control Movement

Effects of Weightlessness on Human Single Muscle Fiber Function
Dr. Robert Fitts, Marquette University, Milwaukee, WI

Objective: Although the skeletal muscles continue to control and move the body when on orbit, astronauts experience muscle wasting similar to the aging process or inactivity. This muscle loss seems to be short-lived and reversible, but long-duration flight effects are unknown.

Procedure: During crew sessions on an exercise ergometer, breathing and heart-rate measurements will be made. Right calf muscle performance will be evaluated using the Torque Velocity Dynamometer workstation. Measurements made several times during the mission will be compared to data collected before and after flight. Muscle fiber samples will be taken 45 days before launch and soon after landing for laboratory analysis.

Relationship of long-term Electromyographic Activity and Hormonal Function to Muscle Atrophy and Performance
Dr. V. Reggie Edgerton, University of California/Los Angeles, Los Angeles, CA

Objective: In space, muscle inactivity may modify movement control and alter chemicals secreted that protect against weakening. Researchers want to know whether unstressed muscles and the nervous system compensate for changes due to lack of adaptation and atrophy and restore movement ability both on Earth and in microgravity.

Procedure: Right arm and leg muscle movement will be measured by the Torque Velocity Dynamometer and electromyograph electrical impulses. Subjects also will compress a Hand-Grip Dynamometer to measure hand strength. To indicate the importance of nervous system fatigue versus tired muscles, the right calf muscles will be tested by repeated exercising to measure both force and electrical activity. Blood samples will monitor growth hormone levels.

Effects of Microgravity on Skeletal Muscle Contractile Properties
Dr. Paolo Cerretelli, Central Medical University, Geneva, Switzerland

Objective: On Earth, we take muscle contraction for granted. In space, without gravitational resistance, muscle function is impaired. This investigation will identify the effects of selective fiber atrophy, or shrinking, by examining muscle contraction data in the left calf.

Procedure: Muscles are made of fibers. Slow-twitch fibers generate force for prolonged, continuous activity, while fast-twitch muscles produce force for rapid movement and exercise. The Percutaneous Electrical Muscle Stimulation device will stimulate muscle contractions, enabling the Torque Velocity Dynamometer equipment to measure physical capabilities of both these muscle types. Contraction measurements will be correlated with Magnetic Resonance Imaging made before and after flight.

Effects of Microgravity on the Biomechanical and Bioenergetic Characteristics of Human Skeletal Muscle
Dr. Pietro di Prampero, University of Udine, Italy

Objective: Studies have shown that the maximum velocity at which a muscle can contract is inversely related to applied load, or resistance. Investigators want to know whether, and to what extent, this inverse relationship changes in microgravity.

Procedure: Using the Torque Velocity Dynamometer, crew members will exert a series of short elbow and ankle contractions made at different joint angles. Electromyograms will be collected to determine the role of nerve input on the total force output of the muscles. Measurements will be made before, during and after the mission. Findings will be complemented by a bedrest study conducted before the mission.

Magnetic Resonance Imaging After Exposure to Microgravity (Ground Study)
Dr. Adrian LeBlanc, Methodist Hospital and Baylor College of Medicine,
Houston, TX

Objective: Many changes have been found in bone, muscle and blood from humans and animals exposed to microgravity. For example, astronauts often experience varying degrees of back pain, possibly related to lengthening of the spine in microgravity. These changes must be understood before longer missions are undertaken.

Procedure: Pre- and post- mission Magnetic Resonance Imaging (MRI) will measure the body's muscles. Muscle volume will be compared to performance measurements gathered on orbit during other experiments. As a complement to MRI data, Dual Energy Absorptiometry will measure total body and regional fat and lean tissue mass, and will monitor fluid redistribution after flight. Investigators also will study changes in the cross-sectional areas of discs in the lower back.

An Approach to Counteract Impairment of Musculoskeletal Function in Space (Ground Study)
Dr. Per Tesch, Karolinska Institute, Stockholm, Sweden

Objective: Investigators are seeking the mechanisms responsible for impaired musculoskeletal function in response to orbital flight. Whether it be muscle atrophy, or some other mechanism, overcoming these effects will enable crews to endure long missions.

Procedure: Before and after flight, electromyograms will determine the magnitude of nerve signals to the muscles being exercised. Using an ergometer with a resistive flywheel, subjects will establish individual values of force-velocity and joint angles and joint angle velocity. Voluntary leg press exercises will define maximum force and power output for each subject. MRI scans will make cross-sectional measurements of crew members' calf and thigh muscles.

Metabolic Investigations -- Regulatory Functions

Direct Measurement of the Initial Bone Response to Space Flight
Dr. Christopher Cann, University of California, San Francisco, CA

Objective: The dynamic human skeleton continually makes and removes bone from the body. In space, reduced gravitational loads may induce the skeleton to discard calcium; bone loss begins shortly after reaching orbit. While seeking countermeasures, researchers may discover treatments for the debilitating disease osteoporosis.

Procedure: Crew members will take a nonradioactive calcium isotope at each meal, from 10 days before the mission to 7 days after. By tracing the isotope in relation to food and drink intake, scientists will distinguish calcium intake from that shed through waste to determine the amount used by bones.

Measurement of Energy Expenditure During Space Flight with the Doubly Labeled Water Method
Dr. Peter Stein, University of Medicine and Dentistry of New Jersey, Stratford, NJ

Objective: This is the first measurement of the relationship between energy needs and calorie intake in space. During missions, crew members often lose weight. Like malnourishment, burning more calories than are ingested results in the breakdown of the body's protein reserves, which can lead to impaired performance and illness.

Procedure: The doubly labeled water method accurately measures energy output. Participants drink water with two nonradioactive isotopes that are shed by the body at different rates and by different paths. Energy expenditure will be analyzed using urine and saliva specimens. To learn how the energy needs in space vary from requirements on Earth, researchers will compare in-flight data with preflight and bedrest data.

Pulmonary Investigation -- Lung Function

Extended Studies of Pulmonary Function in Weightlessness
Dr. John West, University of California/San Diego, La Jolla, CA

Objective: Previous flight studies indicate gravity is not the only factor in perfusion/ventilation gas flow and blood flow differences between the top and bottom of the lung. These changes will be measured before and during exercise to determine the mechanisms of ventilatory changes.

Procedure: Using astronaut lung function experiment equipment, the crew member will inhale either cabin air or a test gas. Exhaled gases will be monitored continuously. A wired vest will gauge rib cage and chest motion to learn how microgravity affects the musculoskeletal aspects of breathing during heavy exercise, deep breathing and rest periods. Data also will be collected before and after flight and several weeks following the mission.

Human Behavior and Performance Investigations -- Sleep, Schedule and Skills

Human Sleep, Circadian Rhythms and Performance in Space
Dr. Timothy Monk, University of Pittsburgh, PA (Ground Study)
Dr. Alexander Gundel, Institute of Aerospace Medicine, Cologne, Germany

Objective: This is the first simultaneous study of sleep, 24-hour circadian rhythms and task performance in microgravity. While cues such as sunrise and sunset help "set" our biological clocks, in low-Earth orbit light and dark periods alternate every 45 minutes as the Shuttle circles the globe.

Procedure: Periodically during the mission, crew members will wear a beltpack connected to a temperature sensor and another to a sleep cap with electrodes that will measure brain waves, eye movements and muscle tone while sleeping. Mood and performance tests will be performed. Urine will be collected to help track normal daily rhythms. An identical ground study will be conducted after the mission.

Microgravity Effects on Standardized Cognitive Performance Measures using the Performance Assessment Workstation
Dr. Samuel Schiflett, U.S. Air Force Armstrong Laboratory, Brooks Air Force Base, TX

Objective: Cognitive, or thinking, skills are critical to successfully performing many on board tasks. This experiment will identify the effects of fatigue versus microgravity on specific information processing skills. In the future, this information may be used to optimize work schedules in space under a variety of conditions. The goal is to maximize productivity and job satisfaction of astronauts on extended missions.

Procedure: Astronauts will use the Performance Assessment Workstation laptop computer to gather performance data including the speed and accuracy of responses to rotated letters, math problems, letter sequences, etc. Data will be collected before and after flight, and on alternate days during the mission.

Neuroscience Investigations -- Adapting to Space

Torso Rotation Experiment
Dr. Douglas Watt, McGill University, Montreal, Quebec, Canada

Objective: Space adaptation syndrome, a common symptom of adjusting to microgravity, produces motion sickness. Although symptoms disappear in a few days, this syndrome is uncomfortable and affects performance.

Procedure: The flight crew at times will wear sensor packages that measure eye, head and torso movements during normal on-orbit activities early, midway and late into the flight. This information will be compared to data obtained before flight to help researchers recommend ways to move in order to reduce discomfort and improve performance.

Canal and Otolith Interaction Studies
Dr. Millard Reschke, NASA Johnson Space Center, Houston, TX

On Earth, we take balance for granted. Those with balance problems, as well as astronauts, will benefit from neuroscience research.

Objective: On orbit, the vestibular system, in the inner ear, becomes confused as to which way is up or down. Disrupting inner ear motion sensors -- semicircular canals and otolith organs -- leads to nausea and disorientation. It is vital to understand how the human vestibular system adapts.

Procedure: The experiment will study head movement and eye coordination in microgravity four times during the mission. Crew members will use special head gear with a screen that displays visual and motion targets; data will be collected on how the head and eyes track these cues. Readaptation times after flight also will be monitored.

Space Biology Experiments

The three space biology experiments and associated science support are managed by Ames Research Center, Mountain View, CA; Kennedy Space Center, FL; and Walter Reed Army Institute of Research, Washington, DC.

Lignin Formation and the Effects of Microgravity: A New Approach
Dr. Norman Lewis, Washington State University, Pullman, WA

Objective: Trees form inferior "reaction" wood when they right themselves from a bend. Lumber and paper industries want to know how to control and prevent this process. Biologists will study how pine seedlings respond on a cellular level to bending stress in microgravity to study the mechanism of this tree growth.

Procedure: The middeck locker Plant Growth Unit provides lighting, air control and specimen chambers that support growth up to 30 days. Pine seedlings will be placed in the chamber in a way that favors reaction wood formation on Earth. The crew will photograph the specimens each day and periodically preserve cuttings for ground-based study.

Development of the Fish Medaka in Microgravity
Dr. Debra Wolgemuth, Columbia College of Physicians and Surgeons, New York, NY

Objective: During embryonic development, a single cell divides into many cells, which become organs and function as a living system. Medaka fish embryos will help researchers determine gravity's role in normal development. This knowledge will contribute to theories about development conditions for other vertebrates, such as humans.

Procedure: The fish embryos will grow in a culture system called the Space Tissue Loss Module in the middeck. This module, designed by the Walter Reed Army Institute of Research, is fully automated except for startup, video transmission and reentry stowage. Scientists will observe the embryos on orbit via video and preserve them at various stages for later study.

Role of Corticosteroids in Bone Loss During Space Flight
Dr. Thomas Wronski, University of Florida, Gainesville, FL

Objective: Corticosteroid hormones are produced by the adrenal gland in response to stress. Excess corticosteroids may contribute to bone changes during space flight, as well as other stressful periods. To develop effective countermeasures, scientists need to determine how microgravity affects bone mass, levels of bone formation and resorption, and bone cell activity.

Procedure: The two self-contained Animal Enclosure Modules, located in the orbiter middeck, will house 12 laboratory rats. While feeding is automatic in this habitat, the crew will monitor the rodents. After flight, the rats will be euthanized for study at a ground-based laboratory.

MICROGRAVITY SCIENCE INVESTIGATIONS

In the microgravity environment of space, the masking forces of gravity are stripped away, allowing scientists to pursue research not possible on Earth. The goal of this research is to improve both production methods and final products of Earth-based industries.

STS-78 microgravity science experiments involve basic fluid physics investigations, advanced semiconductor and metal alloy materials processing, and medical research in protein crystal growth. These are conducted primarily through "telescience," a mode of operation where scientists on the ground remotely command experiments in orbit. Crew involvement is complementary -- they will check out and activate equipment once on orbit and install and remove samples.

Bubble, Drop and Particle Unit -- Fluid Physics Research

Fluid physics research in the Bubble, Drop and Particle Unit (BDPU) may lead to advances in materials processed on Earth. To enable this type of progress, scientists need a better understanding of fluid processes that play a role in the production of most materials. On Earth, gravity-induced flows, such as convection, often hide more subtle effects. By contrast, in space-based investigations these more subtle fluid processes often dominate movements in fluids. Using the BDPU, the fluid physics investigations will help uncover processes involving either gas bubbles, liquid drops or liquid layers. Products that will benefit from this research include new high-strength metals and temperature-resistant glasses and ceramics for building everything from better electric power plants to future spacecraft.

The BDPU was developed by the European Space Agency. Commands sent from the ground will inject bubbles or drops into liquid-filled test cells and then subject the cells to specific changes in temperature. Cameras and sensors will observe and record temperature, pressure and position of the bubbles or drops. The test cells will be used to study how bubbles and drops react in liquids with varying temperatures and concentrations, how they affect solidification, how convection affects liquid layers at different temperatures, and how evaporation and condensation affect bubble creation and growth, and how liquid columns react to electrical fields.

Bubbles and Drops Interaction with Solidification Fronts
Dr. Rodolfo Monti, University of Naples, Italy

Objective: As molten crystal and glass begin to solidify, gas bubbles may form, causing imperfections in the final product. Also, ingredients of liquid metal mixtures may separate during melting or solidification, forming bubbles or droplets in the mixture. This investigation will provide insight into better ways to prevent these flaws from occurring.

Procedure: A solid tetracosane test sample with implanted gas bubbles will be melted at low temperatures. Once melted completely, the liquified tetracosane, now transparent, will be cooled, and a new solidification process will occur. The resulting interaction between moving pre-formed air bubbles and the solidifying edge will be studied.

Evaporation and Condensation Kinetics at a Liquid Vapor Interface; and Efficient Cooling of High Powered Small Electronic Devices by Boiling under Microgravity
Dr. Johannes Straub, Technical University of Munich, Germany

Objectives: The main goal of the first study is to investigate vapor bubble formation and collapse during evaporation and condensation. This will provide a better understanding of these processes, with applications for many technical operations that use heat and mass transfer.

A second study investigates heat transfer during boiling, using small heaters of different shapes and sizes. Since boiling is a very efficient way to exchange heat, it is used in many energy conversion systems that will benefit from research in this field. For example, boiling can be used to cool small, high-powered electronic devices, such as computer chips.

Procedures: These experiments flew on the second International Microgravity Laboratory (IML-2) in 1994. The test liquid is an alternative refrigerant, R123, which allows higher pressures and temperatures than the refrigerant used on IML-2. In the Evaporation and Condensation Kinetics at a Liquid Vapor Interface experiment, a vapor bubble is generated by a short heating pulse from a heater in the liquid.

The bubble remains and grows where it forms and is observed over time. Cooling or pressure increases are used to force the gas bubbles to collapse or condense back to liquid. For the second experiment, investigators will use advanced hardware, combining optical and electronic systems, to examine heat transfer between the heater, the liquid and the vapor that is formed on boiling.

The Electrohydrodynamics of Liquid Bridges
Dr. Dudley Saville, Princeton University, Princeton, NJ

Objective: This investigation will provide information about the stability of columns of a dielectric material (in this case, a liquid) that barely conducts electricity when placed in another liquid or in air and is subjected to an electric field.

This research may find application in industrial processes where the control of a liquid column or spray is necessary, such as ink-jet printing and polymer fiber spinning.

Procedure: The experiment will focus on the shape changes that occur in a fluid bridge suspended between two electrodes. While applying direct or alternating electrical fields, scientists can study the bridge's change as its ends are draw apart and the field is changed from a cylinder to a vase-like shape until the column finally breaks. The electric fields generated should stabilize the liquid columns even as they are stretched past the point when surface tension would normally cause them to break. Fluids to be studied include castor oil, eugenol and silicone oil.

Nonlinear Surface Tension Driven Bubble Migration
Dr. Antonio Viviani, Second University of Naples, Aversa, Italy

Objective: This experiment continues investigations into the motion of bubbles immersed in a liquid in a container with hot and cold walls on opposite sides. The study of this phenomenon applies to controlling defects in many aspects of materials processing in space, such as the solidification of better and stronger metals, alloys, glasses, and ceramics.

Procedure: Air bubbles of various sizes will be injected into a water-and-alcohol solution that is hot on one end and cold on the other. Investigators will vary the temperature and determine the speed and position of the bubbles. Of particular interest is the ability to control bubble motion at the temperature of the liquid in which the bubble has little tendency to move. Video images will assist scientists controlling the experiment from the ground.

Oscillatory Marangoni Instability
Dr. Jean-Claude Legros, Free University of Brussels, Belgium

Objective: Many manufacturing processes depend on melting and resolidifying a material encapsulated by a liquid coating in order to make single crystals for use in electronics. Often, the individual liquid components will flow due to Marangoni convection -- fluid flows caused by surface tension. Understanding this process is important for manufacturing of this nature.

Procedure: Scientists will gather data to accurately model these flows. A layer of methanol fluid will be placed between two layers of n-octane, a fluid that will not mix with methanol, and will be subjected to temperature differences. Investigators will study the flows in each layer to identify the temperature at which convection becomes unstable. Results will be compared with computer model predictions.

Thermocapillary Migration and Interactions of Bubbles and Drops
Dr. Shankar Subramanian, Clarkson University, Potsdam, NY

Objective: Bubbles and drops are components in the formation of metal mixtures and other materials processing applications, such as solidification. In long-duration space missions, for example, separation processes for waste material recycling might involve bubbles and drops. This experiment studies bubble and drop movements in a liquid under varying temperatures.

Procedure: Up to six test-run series will be conducted, each lasting about four hours, at various temperatures. In each series, six to ten bubbles or drops will be injected, two at a time, while investigators on the ground monitor their motions and interactions through on-orbit video.

Advanced Gradient Heating Facility -- Materials Processing

Scientists perform materials processing experiments to understand the conditions at which freezing materials change from solidifying with a flat boundary or transition surface (edge) to solidifying with cellular and dendritic (tree like) transition shapes. They also want to determine the influences that affect these changes, to enable achieving the exact structure desired in a material. Using the Advanced Gradient Heating Facility (AGHF) furnace for solidifying alloys and crystals, scientists can study these changes in ways that are not possible on Earth, improving our understanding of materials processing.

The AGHF uses pulses of electrical current to mark the internal shape of a material's solidifying edge, a process called Peltier pulse marking. By examining cross-sections of these crystals, scientists can locate these marks and determine the precise growth rate for each portion of a sample, as well as the shape of the crystal edge at the time of the pulse. The six materials processing experiments in this facility will increase knowledge of the physical processes involved in solidification, improving materials processing on Earth and in space.

Comparative Study of Cells and Dendrites During Directional Solidification of a Binary Aluminum Alloy at 1-g and under Microgravity
Dr. Henri Nguyen Thi, University of Marseille, France

Objective: The growing edge of a solidifying material forms cellular shapes as its temperature changes quickly, and tree-like dendrite shapes when its temperature changes very quickly. Although researchers have conducted numerous Earth-based studies about the exact conditions at which these shapes change, many questions remain about how to improve microscopic qualities of materials by controlling this process.

Procedure: This experiment will melt and solidify two samples of an aluminum alloy at a precise growth rate. Then, they will be flash-cooled to preserve the shapes of their solidification boundaries. After the mission, these samples will be cut and polished so that investigators can determine the structure's qualities.

Coupled Growth in Hypermonotectics
Dr. Barry Andrews, University of Alabama at Birmingham, Birmingham, AL

Objective: Scientists are interested in a number of unique alloys that cannot be easily produced on Earth because the ingredients separate during processing. Controlling the internal structure of these materials during solidification could lead to alloys for engineering, chemical and electronic applications. On Earth, however, gravity hinders solidification studies.

Procedure: This experiment will process aluminum and indium samples, maintaining a flat edge as the material solidifies, so that indium fibers are more evenly spread and aligned in the final product. After the mission, investigators will cut, etch and chemically analyze sections of the samples to study the evenness of their structures.

Effects of Convection on Interface Curvature during Growth of Concentrated Ternary Compounds
Dr. Thierry Duffar, Atomic Energy Commission, Grenoble, France

Objective: As a metal alloy or semiconductor crystal solidifies, fluid flows and the movement of the solid's growing edge can cause the material's ingredients to separate, forming an uneven sample. Studies of this undesirable effect are hindered by gravity, which changes the shape of the sample's solid edge and causes flows that hide diffusion effects.

Procedure: This experiment will melt and resolidify a ternary, or three component, gallium-indium-antimony sample. The crucible containing the experiment will control the shape of the sample's solidification front and mark it with Peltier pulses. After flight, scientists will analyze curvature of the front and the sample's compositional uniformity.

Equiaxed Solidification of Aluminum Alloy
Dr. Denis Camel, Atomic Energy Commission, Grenoble, France

Objective: Depending on its temperature and other conditions, solidifying metal mixtures form either ordered, long column-like grains or unordered round grains that form around core particles, or nuclei. Investigators will compare samples processed in this experiment with theoretical models to better understand the influence of natural fluid flows in Earth-based metal alloy processing.

Procedure: Two samples of an aluminum-copper mixture will be solidified in a cartridge, one at a nearly constant temperature and the other in a high temperature gradient. One other cartridge with a different quantity of nuclei in the sample will be processed under identical conditions. The samples' structure then will be compared with those of theoretical models.

Interactive Response of Advancing Phase Boundaries to Particles
Dr. Ulrike Hecht, Aachen Center for Solidification in Space, Germany

Objective: Many composites, such as metal mixtures with particles in their crystal structures, offer unique properties such as strength and flexibility. Understanding the interaction between free-floating particles and the growing edge of a solidifying material will help verify theoretical models used to develop new materials and design better industrial processes.

Procedure: This experiment investigates the effects of solidification conditions on the spread of particles in a sample as it crystallizes. It focuses on the different shapes that form on the growth boundary of the solid region and how the development of these shapes is affected as the boundary contacts floating particles.

Particle Engulfment and Pushing by Solidifying Interfaces
Dr. Doru Stefanescu, University of Alabama, Tuscaloosa, AL

Objective: This experiment is designed to improve the understanding of the physics of liquid metals containing ceramic particles as they solidify. It also will investigate aspects of processing metal mixtures in microgravity to improve such processing on Earth.

Procedure: Two pure aluminum samples and one aluminum-nickel alloy will be solidified in the AGHF. Scientists will examine the samples after the flight to determine how fast the metal's solidification front must grow to engulf zirconia particles, instead of pushing them. A complementary ground-based experiment will use organic and polystyrene materials to simulate the solidification and help validate theoretical models of the process.

Advanced Protein Crystallization Facility -- Medical Research

The Advanced Protein Crystallization Facility (APCF) is the first facility ever designed to use three methods of protein crystal growth. By examining the molecular structure of proteins, medical researchers will gain insight into these basic building blocks of life. The APCF experiments could improve food production, as well as lead to innovative new drugs to combat disease.

Protein crystals, like snowflakes, are structured in a regular pattern. Earth-grown crystals show the effects of a growth process analogous to a sports stadium filling with fans who all have reserved seats. Each molecule of a crystal also has its own "reserved" seat. Once the gates open, people flock to their seats and in the confusion often sit in someone else's place. On Earth, gravity-driven convection keeps the molecules crowded around the "seats" as they attempt to order themselves. Unfortunately, many molecules take the wrong place or collapse. Such flaws are greatly reduced in microgravity.

Upon reaching orbit, the crew will activate the APCF, monitor the facility as it operates and deactivate the equipment prior to re-entry. After the mission, investigators will study approximately 5,000 video images to determine why and how crystal formation occurs. The space-grown crystals will be analyzed to determine their internal molecular arrangement. As X-rays diffract off the atoms of the space-grown crystals, a computer will map each atom's position.

Advanced Protein Crystallization Facility on the Life and Microgravity Sciences Mission
Dr. Alexander McPherson, University of California, Riverside,

The experiment team will work from remote sites and will be linked by teleconferencing instead of being based at a centralized facility. This foreshadows the way experiments will be conducted during the International Space Station era.

This investigation provides a particularly valuable opportunity because a large variety of experiments covering a broad range of samples and conditions can be conducted simultaneously. These experiments will contribute to better understanding of crystal growth on Earth and to the ability to define that process in conventional laboratories, possibly accelerating important advances in biotechnology, medicine, agriculture and industry. This experiment will grow a variety of protein and virus crystals. While protein samples will be included among the samples, the emphasis will be on viruses.

Crystallization of EGFR-EGF
Dr. Christian Betzel, European Molecular Biology Laboratory, Hamburg, Germany

The receptor for the epidermal growth factor is an important predictor for a series of human diseases. Knowledge of the three-dimensional shape of this molecule could open the possibility of tailoring appropriate drugs for the treatment of numerous types of tumors.

Crystallization of Crustacyanin Subunits
Dr. Naomi Chayen, Imperial College, London, United Kingdom

Crustacyanin is a member of the lipocalin protein group, which binds to certain pigments found in many plants and animals. Knowledge of the structure of the lipocalins will enable scientists to engineer proteins that will bind more strongly to pigments with anti-cancer properties.

Crystallization of Engineered 5S rRNA Molecules
Dr. Volker Erdmann, Free University of Berlin, Germany

The ribonucleic acid (RNA) 5S rRNA interacts with a number of proteins in cells and is essential for the biological activity in the part of the cell that produces proteins. Performed with intact and active RNA molecules, it will increase knowledge about the effects of microgravity on the crystallization of biological molecules.

Crystallization of Thermus Thermophilus AspRS
Dr. Richard Giege, National Center for Scientific Research, Strasbourg, France

Ground-based investigations have successfully crystallized two tRNA proteins. The crystal quality of the first protein complex, however, is inferior to that of one with natural rRNA. On the LMS mission, researchers will grow these crystals in dialysis cells to obtain higher resolution X-ray data than is obtainable in ground-based laboratories.

Monitoring of Lysozyme Protein Crystal Growth in Microgravity via a Mach-Zehnder Interferometer and Comparison with Earth Control Data
Dr. John Helliwell, University of Manchester, United Kingdom

Essentially perfect lysozyme crystals grown on earlier missions were three times more uniform than Earth-grown samples. Investigators want to determine the best duration of a microgravity mission for protein crystallization.

Crystallization of the Nucleosome Core Particle in Space
Dr. Timothy Richmond, Swiss Federal Institute of Technology, Zurich, Switzerland

The nucleosome core particle is the larger part of the nucleosome, part of the complex forming the major portion of the core material in cells that have a definite center. On LMS, scientists hope to obtain crystals with high uniformity that will allow more precise data collection.

Enhanced Resolution Through Improved Crystal Quality in the Crystal Structure Analysis of Photosystem I
Dr. Wolf Schubert, Free University of Berlin, Germany

In photosynthesis, the proteins Photosystem I and Photosystem II are responsible for the main conversion of visible light into chemical energy. This experiment will reveal details of the complete arrangement of chlorophyll molecules, which efficiently perform this conversion process.

Mechanism of Membrane Protein Crystal Growth: Bacteriorhodopsin -- Mixed Micelle Packing at the Consolution Boundary, Stabilized in Microgravity
Dr. Gottfried Wagner, University of Giessen, Germany

Bacteriorhodopsin converts light into voltage in the skins of light-sustained microorganisms, which are chemically and genetically different from bacteria and higher life forms. Resolution of the three-dimensional shape of this protein will help scientists understand the processes used to convert light to growth energy.

Crystallization in a Microgravity Environment on CcdB, a Protein Involved in the Control of Cell Death
Dr. Lode Wyns, Free University of Brussels, Belgium

Better understanding of the shape and behavior of the CcdB protein may lead to the design of new antibiotics and anti-tumor drugs. Specifically, crystal quality needs to be improved. On STS-78, researchers want to crystallize three specific samples that are large enough for data collection.

Crystallization of Sulfolobus Solfataricus Alcohol Dehydrogenase
Dr. Adrian Zagari, University of Naples, Italy

Alcohol dehydrogenase (ADH) is found in large amounts in the livers of mammals and plays an important part in several functions, including the breakdown of alcohol. Mammalian ADH is unsuitable at high temperatures. This limits its application to the making of organic compounds. ADH from certain bacteria that grow in high temperatures has greater stability, however, and is less affected by high temperatures. This substance is a good candidate for industrial applications.

Growth of Lysozyme Crystals at Low Nucleation Density
Dr. Juan Garcia-Ruiz, University of Granada, Spain

This experiment will use a new approach to lysozyme crystallization to evaluate the usefulness of ground-based experiments in predicting growth behavior under microgravity conditions. It also will test the accuracy of computer simulations of one-dimensional cells developed in terrestrial laboratories.

Accelerometers -- Characterizing the Microgravity Environment

Space Acceleration Measurement System (SAMS)
Ron Sicker, Project Manager, NASA Lewis Research Center, Cleveland, OH
Orbital Acceleration Research Experiment (OARE)
Bill Wagar, Project Manager, NASA Lewis Research Center, Cleveland, OH
Microgravity Measurement Assembly (MMA)
Maurizio Nati, Project Manager, European Space Agency/European Space Research and Technology Center, Noordwijk, The Netherlands

Microgravity science investigations require a stable, low-gravity environment to yield the most accurate data. Vibrations caused by crew activity and by the operation of thrusters, fans and cameras in the orbiter can impact the quality of research. LMS includes three instruments to measure the microgravity environment. By analyzing types of microgravity disturbances, researchers can assess the influence of Shuttle accelerations and other disturbances on scientific experiments.

The Space Acceleration Measurement System (SAMS) measures high-frequency accelerations such as Shuttle thruster firings. Several materials and fluid science experiments are particularly sensitive to accelerations in the frequency ranges that SAMS will record.

As the Shuttle travels at 17,500 miles per hour, it slows down slightly due to atmospheric friction. Also, friction varies as atmosphere density changes from day to night and with altitude. The Orbital Acceleration Research Experiment (OARE) makes extremely accurate measurements of low-frequency changes in accelerations and vibrations experienced during on-orbit operations

The Microgravity Measurement Assembly (MMA) facility determines both high- and low-frequency spacecraft disturbances. This onboard system provides a network of sensors at selected locations inside the Spacelab module and integrates the output of experiment-dedicated and remote sensors into an unified data set.

STS-78 MISSION MANAGEMENT

The Life and Microgravity Spacelab mission is directed by Program Manager David Jarrett; Life Sciences Program Scientist Dr. Victor Schneider; Microgravity Program Scientist Dr. Bradley Carpenter and Life Sciences Instrument Program Manager Angie Jackman, all of NASA Headquarters, Washington, DC. Responsible for Mission Management at the Marshall Space Flight Center in Huntsville, AL are Mission Manager Mark Boudreaux and Mission Scientist Dr. James Patton Downey. Life Science Project Scientist is Dr. Mel Buderer from the Johnson Space Center, Houston, TX. Flight Manager is Mr. Denny Holt, also from Johnson.

STS-78 CREW BIOGRAPHIES

Terence T. "Tom" Henricks (Colonel, USAF) will serve as Commander for STS-78. Henricks was born July 5, 1952, in Bryan, Ohio, but considers Woodville, Ohio, to be his hometown. He graduated from Woodmore High School in 1970, a bachelor of science degree in civil engineering from the United States Air Force (USAF) Academy in 1974, and a masters degree in public administration from Golden Gate University in 1982.

Henricks was selected by NASA in June 1985 and became an astronaut in July 1986. A veteran of three space flights, Henricks has logged over 620 hours in space. He was the pilot on STS-44 in 1991, and STS-55 in 1993, and was the spacecraft commander on STS-70 in 1995.

Kevin R. Kregel will serve as the Pilot for Mission STS-78. Kregel was born September 16, 1956 and grew up in Amityville, New York. He graduated from Amityville Memorial High School, Amityville, New York, in 1974, a bachelor of science degree in astronautical engineering from the U.S. Air Force Academy in 1978 and a master's degree in public administration from Troy State University in 1988.

Kregel was selected by NASA in March 1992. He was the pilot on STS-70 in 1995, and has logged over 214 hours in space.

Richard M. Linnehan (DVM) will serve as Mission Specialist-1 on the STS-78 mission. Linnehan was born September 19, 1957, in Lowell, Massachusetts. He graduated from Pelham High School, Pelham, New Hampshire in 1975, received a bachelor of science degree in animal sciences with a minor in microbiology from the University of New Hampshire in 1980 and the degree of Doctor of Veterinary Medicine from the Ohio State University College of Veterinary Medicine in 1985.

Linnehan was selected by NASA in March 1992. He completed his one year of training to be qualified for assignment as a mission specialist in on a future Space Shuttle flight crews in 1993. STS-78 will be Linnehan's first space flight.

Susan J. Helms (Lieutenant Colonel, USAF) is the Payload Commander for STS-78 and is also Mission Specialist-2. Helms was born February 26, 1958, in Charlotte, North Carolina, but considers Portland, Oregon, to be her hometown. She graduated from Parkrose Senior High School, Portland, Oregon, in 1976, received a bachelor of science degree in aeronautical engineering from the U.S. Air Force Academy in 1980 and a master of science degree in aeronautics/astronautics from Stanford University in 1985.

Helms was selected by NASA in January 1990 and became an astronaut in July 1991. She has flown as a mission specialists on two Shuttle flights - STS-54 in January 1993 and STS-64 in September 1994. In completing her two missions, Helms has logged a total of 406 hours in space.

Charles E. Brady, Jr. (Commander, USN) will serve as Mission Specialist-3 on the STS-78 mission. Brady was born August 12, 1951, in Pinehurst, North Carolina, but considers Robbins, North Carolina, to be his hometown. He graduated from North Moore High School, Robbins, North Carolina, in 1969, was pre-med at University of North Carolina at Chapel Hill, 1969-1971 and received a doctorate in medicine from Duke University in 1975.

Brady was selected by NASA in March 1992 and qualified for selection as a mission specialist on future Space Shuttle flight crews in 1993. In May 1995 he was assigned as a mission specialist for the LMS mission. STS-78 will be Brady's first space flight

Jean-Jacques Favier (Ph.D.) will serve as Payload Specialist-1 on the STS-78 mission. Favier was born April 13, 1949, in Kehl, Germany. He attended primary and secondary schools in Strasbourg, France, received an engineering degree from the National Polytechnical Institute of Grenoble in 1971 and a Ph.D. in engineering from the Mining School of Paris and a Ph.D. in metallurgy and physics from the University of Grenoble in 1977.

Favier has been a CNES payload specialist candidate since 1985. He was assigned as an alternate payload specialist on Mission STS-65, the second International Microgravity Laboratory mission that flew in July 1994. In May 1995 was assigned as a payload specialist for the STS-78 LMS mission. This will be Favier's first space flight.

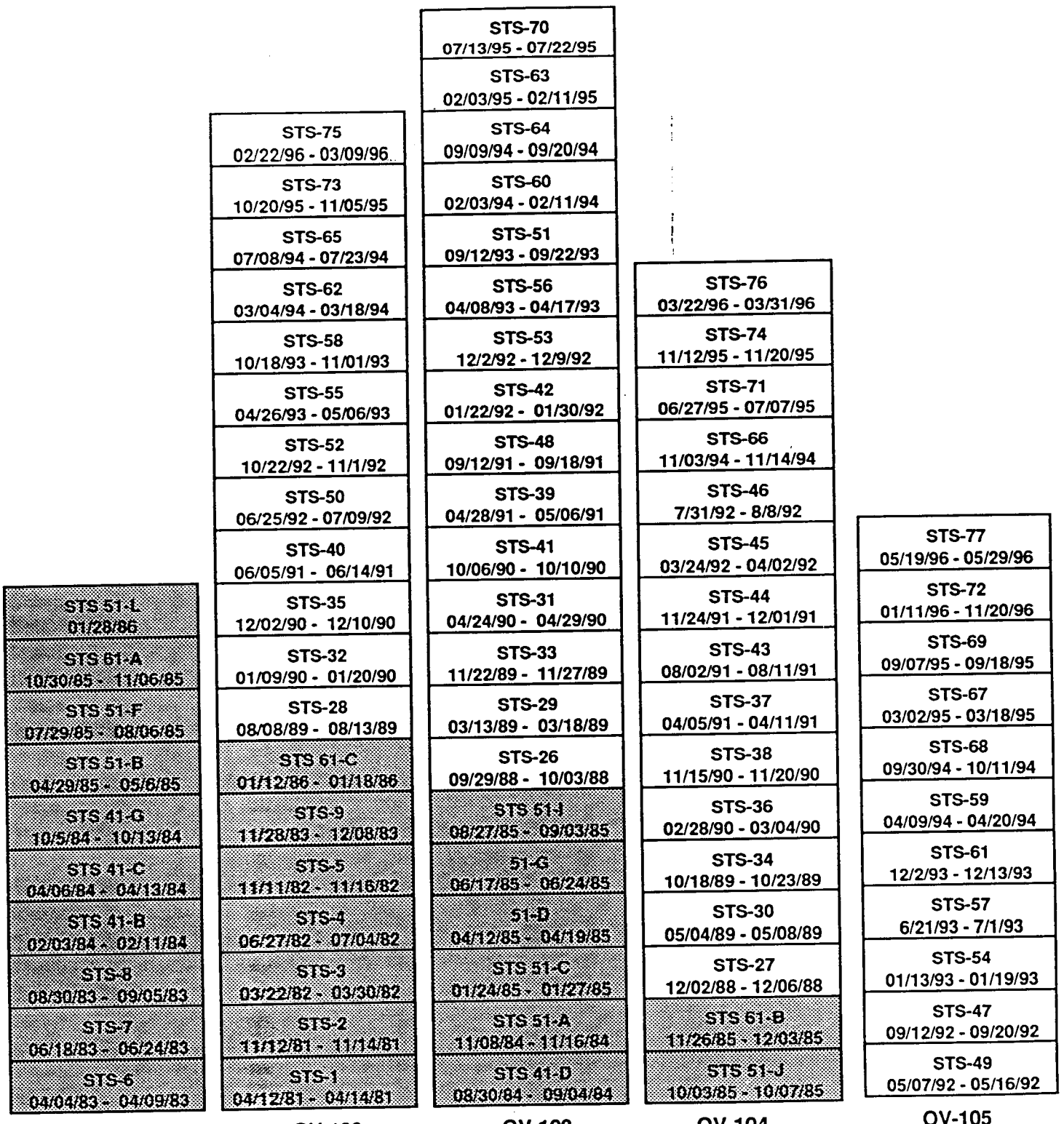
Robert (Bob) Brent Thirsk (M.D., P.Eng.) will serve as Payload Specialist-2 on the STS-78 mission. Thirsk was born August 17, 1953 in New Westminister, British Columbia. He attended primary and secondary schools in British Columbia, Alberta, and Manitoba, received a bachelor of science degree in mechanical engineering from the University of Calgary in 1976, a master of science degree in mechanical engineering from the Massachusetts Institute of Technology (MIT) in 1978 and a doctorate of medicine degree from McGill University in 1982.

Thirsk was one of the six Canadian astronauts selected in December 1983 and served as back up Payload Specialist to Marc Garneau for Mission 41-G in October 1984. In April 1995, Dr. Thirsk was selected to participate in the Life and Microgravity Spacelab mission. STS-78 will be Thirsk's first space flight.

For complete biographical information on NASA astronauts, see the NASA Internet astronaut biography home page at address: http://www.jsc.nasa.gov/Bios/

SHUTTLE FLIGHTS AS OF MAY 1996

77 TOTAL FLIGHTS OF THE SHUTTLE SYSTEM – 52 SINCE RETURN TO FLIGHT



UPCOMING SHUTTLE MISSIONS

MISSION	ORBITER	MAJOR PAYLOADS	TARGET DATE	MISSION DURATION
STS-79	ATLANTIS	Shuttle-Mir Mission-4	AUG. 1, 1996 11:42 p.m. EDT (7/31/96)	9+1 Days
STS-80	COLUMBIA	ORFEUS-SPAS WSF	OCT. 31, 1996	16 Days
STS-81	ATLANTIS	Shuttle-Mir Mission-5	DEC. 5, 1996	9+1 Days
STS-82	DISCOVERY	Hubble Space Telescope-Servicing Mission-2	FEB. 13, 1997	10 Days
STS-83	COLUMBIA	Microgravity Science Laboratory-1	MAR. 27. 1997	16 Days
STS-84	ATLANTIS	Shuttle-Mir Mission-6	MAY 1, 1997	9+1 Days
STS-85	DISCOVERY	CRISTA-SPAS-2 MFD, TAS, IEH	JULY 17, 1997	11+1 Days
STS-86	ATLANTIS	Shuttle-Mir Mission-7	SEPT. 11, 1997	9+1 Days

Note: The above information is subject to change. It is based on current assessed target launch dates used as a part of processing and planning activities for upcoming Shuttle missions. The official launch date for a mission is set at the Flight Readiness Review meeting held approximately 2 weeks before launch.

Video Advisory

National Aeronautics and
Space Administration
Washington, DC 20546
(202) 358-1600

For Release

Deanna Corridon
Headquarters, Washington, DC
(Phone: 202/358-1733)

June 12, 1996

VIDEO ADVISORY: V96-70

PIONEERING VIRTUAL PLASTIC SURGERY; REGENERATIVE LIFE SUPPORT TESTING ON NTV WEDNESDAY

On Wednesday NASA TV will televise footage of NASA technology being utilized by surgeons to plan and visualize complex reconstructive surgical procedures in a virtual environment simulator. Also on NASA TV, life scientists at the Kennedy Space Center (KSC), FL, begin NASA's most realistic long-term reliability testing on a Biomass Production Chamber (BPC) which will contain plants used to support human habitation in space. Replaying on NTV, will be animation showing the Life and Microgravity Spacelab for the STS-78 mission scheduled to launch on June 20.

ITEM #1: VIRTUAL MAKEOVER
Surgeons use virtual reality to plan and visualize complex reconstructive surgical procedures. *For more information contact Ann Hutchison at (415) 604-4968.*

ITEM #2: INTERVIEW - DR. MURIEL ROSS, DIRECTOR OF BIOCOMPUTATION CENTER
Discusses the advantages of virtual reconstructive surgery.

ITEM #3: INTERVIEW - DR. STEPHEN SCHENDAL, DIVISION CHIEF OF PLASTIC SURGERY, STANFORD UNIVERSITY MEDICAL CENTER
Discusses the benefits of reconstructive surgery.

ITEM #4: WHEAT AND POTATOES
Scientists at KSC initiate NASA's most realistic test on plants for human life support in space. *For more information contact Michael Braukus at (202) 358-1979.*

ITEM #5: INTERVIEW - RAY M. WHEELER, PH.D., PLANT PHYSIOLOGIST
Discusses why regenerative life support is essential for human habitation in space.

ITEM #6: INTERVIEW - JAY GARLAND, PH.D., CELSS PROJECT SUPERVISOR
Discusses the importance of recycling plants and human waste in space.

ITEM #7: INTERVIEW - GARY STUTTE, PH.D., LEAD PLANT PHYSIOLOGIST
Discusses the preparation of potato plants before being placed into the BPC.

ITEM #8: STS-78 ANIMATION
Animation of the Life and Microgravity Spacelab for the upcoming STS-78 mission. *For more information contact Ed Campion at (202) 358-1780.*

Video news files will air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

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News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

June 12, 1996

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Headquarters, Washington, DC
(Phone: 202/358-1760)

Laura-Lee Davidson
Quality Education for Minorities Network, Washington, DC
(Phone: 202/659-1818)

RELEASE: 96-117

1996 SHARP PLUS APPRENTICES SELECTED

NASA and the Quality Education for Minorities (QEM) Network have selected 300 high school students as apprentices to engage in cutting-edge science and engineering research activities as part of NASA's SHARP PLUS Research Apprenticeship Program.

The program enables students, under the guidance of industry or university-based mentors, to spend eight weeks in residence at 14 universities that have joined with NASA and QEM to increase the participation and success rates of highly talented students who are underrepresented in mathematics and science courses at the pre-college level.

Chosen from a pool of 1,000 applicants, the apprentices (179 female and 121 male students) come from 29 states, Puerto Rico, the U.S. Virgin Islands, Washington, DC, and a U.S. military base in Germany.

SHARP PLUS sets high academic standards and seeks to increasing, strengthening, and diversifying the pool of students for mathematics, science, and engineering college majors and careers.

The program is administered by the QEM for NASA's Education Division, which is tasked to promote excellence in America's education system by involving the education community in endeavors to inspire American students, create learning opportunities, and enlighten inquisitive minds. The QEM Network is a non-profit organization dedicated to improving the education of minorities and other underrepresented groups throughout the nation.

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News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

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Headquarters, Washington, DC
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Mary Beth Murrill
Jet Propulsion Laboratory, Pasadena, CA
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For Release
June 12, 1996

RELEASE: 96-118

ASTRONOMERS FIND KEY TO LOCATING HOTBEDS OF STARBIRTH

A team of U.S. astronomers working with data from the European Space Agency's Infrared Space Observatory (ISO) have discovered a clear-cut infrared signature that reveals hotbeds of star formation hidden within spiral galaxies.

Researchers presenting their results at a meeting of the American Astronomical Society in Madison, WI, say the discovery will streamline efforts to look at galaxies across the universe and easily find the areas where unusually intense episodes of starbirth are occurring.

"At the same time, the discovery may help explain why some areas within a galaxy burst forth with new stars but other similar regions remain comparatively quiescent," said Dr. George Helou, NASA's ISO project scientist and an astronomer at the NASA/JPL Infrared Processing and Analsyis Center (IPAC) at Caltech, Pasadena, CA. Helou leads a key ISO project to understand the properties and evolution of the interstellar medium of normal spiral galaxies such as our own Milky Way.

An infrared image of galaxy NGC 6946 produced with ISO data and processed at IPAC clearly shows bright areas seen at 7 and 15 microns where star formation is taking place. The galactic nucleus appears to be a hub of star birth, as are distinct areas along the galaxy's spiral arms.

Starbirth commonly takes place behind curtains of galactic dust and gas. ISO's infrared detectors, however, "see" the heat emitted from behind those curtains. The color composite image of NGC 6946 was made with data from ISO's mid-infrared camera. The instrument was built by a consortium led by Dr. Catherine Cesarsky of the CEA/Saclay Institute near Paris, France.

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"We know from studying other galaxies that when they merge or collide, they create a burst of star formation. But in this case, there's no collision and no culprit to identify as the catalyst for star formation. In the absence of galactic collisions, why should there be any starburst at all. More data on this and other starburst regions from ISO and other infrared studies will help answer this question," Helou said.

Other key ISO experiments being conducted by U.S. astronomers are studies of quasars, investigations of dust debris around Sun-like stars and the birth and death of planetary systems. In addition to these experiments, more than one hundred U.S. astronomers are receiving observing time on ISO to conduct other investigations. The ISO was launched into Earth orbit November 16, 1995.

EDITOR'S NOTE: Images to illustrate this release are available to media representatives by calling the Headquarters Imaging office at 202/358-1900. Photo numbers are:

	Color	B&W
NGC 6946	96-HC-374	96-H-374

- end -

NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. NASA releases also are available via CompuServe using the command GO NASA.

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

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Headquarters, Washington, DC
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June 12, 1996

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(Phone: 415/604-4968)

Mike Goodkind
Stanford University Medical Center News Bureau, Palo Alto, CA
(Phone: 415/725-5376)

RELEASE: 96-119

NASA TECHNOLOGY ASSISTS RECONSTRUCTIVE SURGERY

NASA technology is making it possible for surgeons to plan complex surgical procedures and to visualize the potential results of reconstructive surgery in a virtual environment simulator.

NASA's Ames Research Center, Mountain View, CA, is collaborating with the Department of Plastic and Reconstructive Surgery at Stanford University Medical Center, Palo Alto, CA, to develop the technology. Their goal is to develop a virtual environment workbench for planning complex craniofacial reconstructive surgery and for training new surgeons, using 3-dimensional (3-D) reconstruction and virtual environment technologies.

The technology will use special software to integrate laser images with computer tomography (CT) scans of a patient's head. This enables the creation of highly precise, 3-D images of the face and skull. Development of these tools also will make it possible to produce virtual environment simulations of common surgical procedures to be used in space for long-term missions.

"Our goal is to allow surgeons to 'see' the face with the skull and enable them to use the same tools in a virtual environment that they would use in the actual surgery," said Muriel Ross, Ph.D., director of Ames' Biocomputation Center, where the work is being done. "We will be able to do patient-specific reconstructions that will allow surgeons to work on the affected bones as though the surgical manipulations were real. The surgeons will be able to remove pieces of bone, cut them into appropriate shapes and place the pieces as desired. Then they can replace the soft tissues and observe the new features before they operate," she said.

-more-

The NASA-Stanford team is especially interested in working with children who need reconstructive surgery to correct deformities of the head and face, and with mastectomy patients needing breast reconstruction. However, since the system is very generalized, Ross said eventually it should be applicable for use in other medical specialties or surgical procedures.

"This technique will allow us to practice an operation several different ways to see which outcome is the best," said Dr. Stephen Schendel, chair of the Department of Plastic and Reconstructive Surgery at Stanford. "This is something surgeons could not do before with any accuracy. They had to rely on many years of experience doing these operations, which was at times less than perfect."

Ross said the new software has several important benefits. Patients with disfigurements should be better satisfied with their appearance after surgery, because "surgeons can see what the result will be before the surgery is even started." It also will increase efficiency by improving the outcome of the surgery and by reducing the time the patient spends in surgery, which should reduce the cost of the procedure.

Since the system is interactive, surgeons in other hospitals can collaborate in complex or critical surgery via high-speed networking lines. "This will allow surgeons at different centers to cooperate in the planning of surgery by sharing 3-D patient data, which expands the existing possibilities for patient care delivery," Schendel said. "Doctors in outlying areas can confer with a specialist in a center miles away."

Finally, the system will make it possible to train craniofacial surgeons, even those in remote areas, without their having to do actual surgery. The surgeons will be able to pick up the same surgical instruments, make cuts and move bone as they would in an actual surgical procedure, only in a virtual environment. Eventually, the training program will include force feedback, sound and tactile components. "There are real financial stresses on medicine today, so training becomes a critical issue, as does time in actual surgery," Schendel said.

To build the 3-D image of the face, plastic surgery resident Dr. Michael Stephanides makes pre-operative laser scans of the patient's face. Ames computer specialists then match facial features to the skull features in CT scans by extracting the bone structure from the series of scans, contouring it and using the special software to reconstruct the skull. Since the reconstructed face is transparent, the bone structure is visible behind it.

The new, advanced technology is based on 3-D reconstruction software originally developed for space research to visualize structural changes in the organization of gravity sensors in animals exposed to microgravity. This software is not only used in NASA's gravitational biology program but it is also

being used by more than 20 scientists around the country, through Space Act Agreements, for a variety of scientific studies including embryonic development, effects of toxic agents on embryos and the organization of the retina. The virtual environment workbench is a new application of this NASA-developed software.

"This exciting opportunity is highly relevant to Ames' focus as NASA's Center of Excellence in Information Technology, and it will help set standards for this type of virtual environment research," Ross said. She hopes to have the final product ready for physician testing within a year. "Everybody here is really excited about what we're doing. It's a situation where everyone wins."

-end-

NOTE TO EDITORS: Images are available on the Internet via the Ames Public Affairs Home Page. The URL is:

http://ccf.arc.nasa.gov/dx

Ames news releases also are available on the NASA Ames Public Affairs Home Page at URL, http://ccf.arc.nasa.gov/dx

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News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Michael Braukus
Headquarters, Washington, DC
(Phone: 202/358-1979)

June 12, 1996

Joel Wells
Kennedy Space Center, FL
(Phone: 407/867-2468)

RELEASE: 96-120

NASA BEGINS STUDY ON RELIABILITY OF SPACE LIFE SUPPORT SYSTEM

Life scientists at NASA's Kennedy Space Center, FL, began the Agency's most realistic ground test to date on plants that will produce food and oxygen for long-duration space missions.

During the experiment, researchers from NASA and Dynamac Corp., FL, will evaluate the ability of 128 potato plants and 6,500 wheat seeds to produce food and oxygen, purify water and recycle waste products. The landmark study, part of NASA's development of a Controlled Ecological Life Support System, is scheduled for a full year and could last up to three years. This experiment marks the first time two crop species have been grown simultaneously in Kennedy's Biomass Production Chamber (BPC).

"We recently completed a study with potatoes that lasted about 14 months," explained NASA agricultural engineer John Sager. "If we plan to live in space though, we must determine if this system will be as successful over longer periods of time."

Through photosynthesis, the wheat and potatoes will produce food, distilled water and oxygen, while removing carbon dioxide from the air. Gradually, researchers will introduce plant and human waste streams from a "bioreactor" to the BPC, and through transpiration the plants will remove and use nutrients from the waste effluent. "In effect, plants may be the air and water filters of the space age," said Ray Wheeler, NASA plant physiologist.

The BPC, a retrofitted test chamber, has an interior composed of two plant chambers. A hydroponics system is used to supply the plants with nutrients and water. Tanks outside the chamber store the water and nutrient solution and special lamps provide artificial sunlight. The controlled environment imitates the confined and resource deficient conditions of space.

- more -

Scientists have been using the chamber since 1987, observing a variety of crops including soybeans, lettuce, tomatoes, white potatoes and wheat. This study focuses on wheat and potato production because of their high productivity and performance in previous trials.

"We hope to see the same positive results and high yields in this study that we have seen in the preceding studies," said Dynamic plant physiologist Gary Stutte. "This research brings us one step closer to supporting life in space for extended periods."

- end -

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News Release

National Aeronautics and
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Washington, DC 20546
(202) 358-1600

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Headquarters, Washington, DC
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Steve Roy
Marshall Space Flight Center, Huntsville, AL
(Phone: 205/544-0034)

Kyle Herring
Johnson Space Center, Houston, TX
(Phone: 713/483-5111)

For Release
June 13, 1996

RELEASE: 96-121

SPACE STATION TRUSS TESTED IN NEUTRAL BUOYANCY SIMULATOR

A major segment of the International Space Station, which houses the communications and tracking, attitude stabilization, thermal control, and electrical power distribution systems, successfully completed tests in the simulated weightlessness of a special water tank.

Assisted by test and safety divers, astronaut teams simulated procedures during a three week test in the Neutral Buoyancy Simulator at NASA's Marshall Space Flight Center, Huntsville, AL. The element tested in the water tank was a high fidelity mock-up of the Z-1 truss segment. The centrally located Z-1 truss structure will deploy antennas, provide cooling to laboratory equipment, and bring electrical power to the Space Station once in orbit. The tests also evaluated the use of mobility aids, handling of equipment, use of foot restraints and hand holds for space walks during Space Station truss assembly.

"The test and development of procedures for truss assembly and maintenance mark an important milestone for the Space Station program," said Randy Brinkley, International Space Station Program Manager at the Johnson Space Center, Houston, TX. "The highly successful work accomplished in the Neutral Buoyancy Simulator is a major milestone in the schedule for the launch of these critical elements of the Space Station."

"Neutral buoyancy provides an excellent environment for testing hardware designed to operate in space while affording the opportunity to evaluate procedures that will be used in space to assemble structures such as the Space Station," according to Bill Barnett, test director at the Neutral Buoyancy Simulator.

-more-

"By attaching a system of floats and weights, suited subjects or equipment neither sink nor float, making the subjects and equipment neutrally buoyant," said Barnett. "The neutral buoyancy facility provides a realistic simulation of working in space, permitting astronauts to test equipment designs, use of tools and to work through portions of actual mission timelines for assembly of objects in space."

"We tested the design for assembly and maintenance of the Space Station's electrical power system and the interfaces to the power system," said Ron Lovely, Rocketdyne Manager of Space Operations and Flight Experiments. "Also, we evaluated tasks and equipment which provide power and other necessary functions to make the living and working places on the Station habitable."

"The simulations at Marshall," Lovely said, "are how we find out if we are meeting all the requirements for extravehicular activities or space walks. This series of tests has gone extremely well. We are very excited and pleased about the progress made toward the verification of the Station for assembly and maintenance in space."

The tests were conducted by Rocketdyne with support from Marshall and Johnson's Mission Operations Directorate. Rocketdyne, based in Canoga Park, CA, is responsible for development and delivery of the electrical power system and associated truss structures for the Space Station.

The first Space Station element, a Russian built, U.S. funded control module called the FGB, will be launched in November 1997.

In December 1997 the U.S. Node, which serves as an attachment point to other U.S. and international partner modules, will be launched by the Space Shuttle and attached to the FGB.

-end-

Video Advisory

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Deanna Corridon
Headquarters, Washington, DC
(Phone: 202/358-1733)

June 14, 1996

VIDEO ADVISORY: V96-72

SUCCESSFUL WING TESTING; NASA PUMPS UP FOR NATURAL GAS; SIGNATURES FLY TO SATURN ON NTV FRIDAY

On Friday NASA TV will televise footage of a full-scale wing designed for a reusable rocket launch vehicle (RLV) undergoing successful "load" testing to determine how much weight it can withstand at the Langley Space Center, Hampton, VA. The structure was deliberately "taken to failure" because it is crucial in designing a vehicle that will be safe for flight. Another piece being featured will be footage of a state-of-the-art natural gas vehicle fueling station that opened at the Kennedy Space Center, FL, that has the capacity to fuel one of the largest fleets of government vehicles. Also on NASA TV, volunteer workers at The Planetary Society, Pasadena, CA, scan signatures sent from people around the world which will be carried aboard the Cassini spacecraft once it begins its mission to Saturn. Replaying on NTV will be footage of of the Z-1 Truss Structure that underwent testing at NASA's Marshall Space Flight Center in a specially designed water tank simulating weightlessness.

ITEM #1: HOW MUCH CAN YOU TAKE?
Full-scale wing segment is tested to determine how much weight it can withstand.

ITEM #2: INTERVIEW - JIM KAMINSKY, X-33 STRUCTURE TEAM LEADER, ROCKWELL
Discusses the importance of testing the wing-box.

ITEM #3: INTERVIEW - JOSEPH NASR, ENGINEERING SPECIALIST FOR HEALTH MONITORING
Explains why testing is conducted at the Langley Research Center.

ITEM #4: INTERVIEW - LELAND MELVIN, HEALTH MONITORING PROGRAM MANAGER, X-33
Discusses the significance of the Health Monitoring System. *For more information contact Ann C. Gaudreaux at (804) 864-8150 or David Steitz at (202) 358-1730.*

ITEM #5: NATURAL GAS
Kennedy Space Center opened a natural gas vehicle fueling station on May 30, 1996.

ITEM #6: INTERVIEW - H. T. EVERETT JR., CHIEF, NASA/KSC OPERATIONS SUPPORT BRANCH
Explains the benefits of using the Natural Gas Fueling Station. *For more information contact Lisa Malone at (407) 867-2468.*

ITEM #7: REPLAY - PUTTING THE TRUSS TO THE TEST

ITEM #8: REPLAY - INTERVIEW - DR. SCOTT PARAZYNSKI, NASA ASTRONAUT

ITEM #9: REPLAY - INTERVIEW - RON LOVELY, SPACE STATION VERIFICATION PRINCIPAL INVESTIGATOR

ITEM #10: REPLAY - INTERVIEW - BILL BARNETT, NEUTRAL BUOYANCY TEST ENGINEER

ITEM #11: REPLAY - INTERVIEW - GEORGE RAY, PRESIDENT AND CEO, LEFIELL COMPANY
For more information contact Steve Roy (205) 544-6536 or Michael Braukus at (202) 358-1979.

ITEM #12: SEND YOURSELF TO SATURN
Signatures from around the world will be taken to Saturn by the Cassini spacecraft.

ITEM #13: ROLL CALL
Volunteers at the Planetary Society scan signatures that will be carried aboard Cassini.

ITEM #14: INTERVIEW - DAVE HAGLE, VOLUNTEER COORDINATOR, PLANETARY SOCIETY
Discusses promoting the public's involvement with The Planetary Society through the Cassini Project. *For more information contact Mary Beth Murrill at (818) 354-5011 or Doug Isbell at (202) 358-1753.*

Video news files will air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

Video Advisory

National Aeronautics and
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Washington, DC 20546
(202) 358-1600

For Release

Deanna Corridon
Headquarters, Washington, DC
(Phone: 202/358-1733)

June 15-17, 1996

VIDEO ADVISORY: V96-73

NASA TELEVISION WEEKEND VIDEO FILE PREMIERES SATURDAY; STS-78 PRE-MISSION ACTIVITIES ON NTV MONDAY

On June 15, 1996, NASA Television will begin a weekend Video File feed during non-Space Shuttle Mission times. The feed will run Saturdays and Sundays at *noon, 3, 6, 9 p.m. and midnight EDT*. On Monday NASA TV will televise pre-mission activity animation, crew preparation footage, and interviews for STS-78 which is scheduled to launch June 20, 1996.

The Weekend Schedule Will Feature:

- **SIGNATURES FLY TO SATURN** - package includes footage and interviews of volunteer workers at The Planetary Society, Pasadena, CA, scanning signatures sent from people around the world which will be carried aboard the Cassini spacecraft once it begins its mission to Saturn.

- **PIONEERING VIRTUAL PLASTIC SURGERY** - package includes footage and interviews of virtual reality technology developed being utilized by plastic surgeons.

- **NASA PUMPS UP FOR NATURAL GAS** - package includes footage and interviews of a state-of-the-art natural gas vehicle fueling station that opened at the Kennedy Space Center, FL, that has the capacity to fuel one of the largest fleets of government vehicles.

- **SUCCESSFUL WING TESTING** - package includes footage and interviews of a full-scale wing designed for a reusable rocket launch vehicle (RLV) undergoing successful "load" testing to determine how much weight it can withstand at the Langley Space Center, Hampton, VA.

- more -

Monday, June 17, 1996:

ITEM #1: STS-78 ANIMATION
Animation showing the Life and Microgravity Spacelab for the upcoming STS-78 mission.

ITEM #2: MISSION PREPARATION
STS-78 crew prepares for mission.

ITEM #3: INTERVIEW - TERRENCE T. "TOM" HENRICKS, STS-78 COMMANDER

ITEM #4: INTERVIEW - KEVIN KREGEL, STS-78 PILOT

ITEM #5: INTERVIEW - SUSAN J. HELMS, STS-78 MISSION SPECIALIST

ITEM #6: INTERVIEW - RICHARD M. LINNEHAN, STS-78 MISSION SPECIALIST

ITEM #7: INTERVIEW - CHARLES E. BRADY, STS-78 MISSION SPECIALIST

ITEM #8: INTERVIEW - JEAN-JACQUES FAVIER PH.D., STS-78 MISSION SPECIALIST

ITEM #9: INTERVIEW - ROBERT "BOB" BRENT THIRSK M.D.

For more information on STS-78 contact Rob Navias at (713) 483-5111 or Ed Campion at (202) 358-1780.

ITEM #10: REPLAY - HOW MUCH CAN YOU TAKE?
ITEM #11: REPLAY - INTERVIEW - JIM KAMINSKY, X-33 STRUCTURE TEAM LEADER, ROCKWELL
ITEM #12: REPLAY - INTERVIEW - JOSEPH NASR, ENGINEERING SPECIALIST FOR HEALTH MONITORING
ITEM #13: REPLAY - INTERVIEW - LELAND MELVIN, HEALTH MONITORING PROGRAM MANAGER, X-33

For more information contact Ann C. Gaudreaux at (804) 864-8150 or David Steitz at (202) 358-1730.

ITEM #14: REPLAY - NATURAL GAS
ITEM #15: INTERVIEW - H. T. EVERETT JR., CHIEF, NASA/KSC OPERATIONS SUPPORT BRANCH

For more information contact Lisa Malone at (407) 867-2468.

Video news files will air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

VideoAdvisory

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For Release

Deanna Corridon
Headquarters, Washington, DC
(Phone: 202/358-1733)

June 18, 1996

VIDEO ADVISORY: V96-74

STS-78 LIFE AND MICROGRAVITY SPACELAB ACTIVITY B-ROLL ON NTV TUESDAY

On Tuesday NASA TV will televise B-roll, animation, and interviews of Life and Microgravity Spacelab activities scheduled for the upcoming STS-78 mission which is set to launch June 20, 1996. Replaying on NTV will be pre-mission activity animation, crew preparation footage and crew interviews.

ITEMS #1-3: BUILDING BLOCKS

Astronauts aboard the Shuttle's Life and Microgravity Spacelab mission will conduct "crystal growth" experiments which could provide improved disease fighting pharmaceuticals and pesticides. [Package includes B-roll and interviews.]

ITEMS #4-6: SPACE MIXING

Research will be conducted during STS-78 on the mixing and the solidification processes involved in manufacturing materials under near-zero gravity conditions. [Package includes B-roll and interviews.]

ITEMS #7-9: FLOWING FLUIDS

Astronauts will study the behavior and characteristics of fluids in microgravity. [Package includes B-roll and interviews.]

ITEMS #10-12: CHANGING LIVES

STS-78 crew will study the changes that occur in living organisms during extended stays in space. [Package includes B-roll & interviews.]

For more information regarding Life and Microgravity Spacelab activities, contact Jerry Berg (205) 544-0034.

ITEM #13: REPLAY - STS-78 ANIMATION

ITEM #14: REPLAY - MISSION PREPARATION

ITEMS #15-21: REPLAY - STS-78 CREW INTERVIEWS

For more information regarding STS-78, contact Rob Navias at (713) 483-5111 or Ed Campion at (202) 358-1780.

Video news files will air daily at noon, 3, 6 and 9 p.m. EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

VideoAdvisory

National Aeronautics and
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For Release

June 19, 1996

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Kennedy Space Center, FL
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VIDEO ADVISORY: V96-75

NASA TV TO OFFER NEW VIEWS OF CREW, LAUNCH AND LANDING

For the first time, NASA Television will offer live views of astronauts inside the crew module of the Shuttle Columbia as they are being strapped in for launch on Thursday, June 20. In addition, seconds before launch, there will be a picture-in-picture view of the Shuttle on the pad with an inset of the three main engines as they start and come up to full thrust.

An inset of Columbia's main engines will appear at T-15 seconds through about T-2 seconds. NASA Television will provide the usual clean video feed of the vehicle as it clears the launch structure through ascent.

The Kennedy Space Center also will provide the usual cadre of video feeds of different views of the STS-78 launch vehicle on several video stumps at the press site.

This mission also will be the first to attempt a live downlink of television images from the Shuttle during descent. The "Pilot Point of View" (PPOV) camera and perspective will be used for all future Columbia missions.

-more-

The PPOV camera is mounted on the "dashboard" adjacent to the vertical strut separating the two forward windows in the flight deck of Columbia. This camera will provide a clear, unobstructed view out the window identical to what the Shuttle's pilot will see during reentry.

Acquisition of the video S-band signal by the Merritt Island Tracking Station is expected when the Shuttle is about 300 miles from the Shuttle Landing Facility traveling at approximately Mach 10.

A second camera will be used to show live crew buckle-in activities prior to launch. The camera also will be used to record crew activity during ascent and descent.

STS-78 is the second Shuttle mission to employ a color television camera mounted in the upper deck crew cabin as a Detailed Test Objective. The first Shuttle mission that used an onboard crew camera was STS-65 in June 1994.

Information on STS-78 is available through several sources on the Internet. The primary source for mission information is the NASA Shuttle Web, part of the World Wide Web. This site contains information on the crew and their mission and will be regularly updated with status reports, photos and video clips throughout the flight. The NASA Shuttle Web's address is:

http://shuttle.nasa.gov

If that address is busy or unavailable, Shuttle information is available through the Office of Space Flight Home Page:

http://www.osf.hq.nasa.gov/

-end-

News Release

National Aeronautics and
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For Release

June 21, 1996

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NOTE TO EDITORS: N96-41

TOMS SPACECRAFT TO BE LAUNCHED ABOARD PEGASUS XL JUNE 29

The launch of NASA's Total Ozone Mapping Spectrometer (TOMS) spacecraft aboard an Orbital Sciences Pegasus XL vehicle is scheduled for Saturday, June 29 at the opening of a 10-minute window which extends from 12:41 - 12:51 a.m. PDT.

Launch is targeted to occur at 12:46 a.m. PDT over the Pacific Ocean approximately 60 miles offshore from Vandenberg Air Force Base, CA. The TOMS Earth Probe satellite (TOMS-EP), built for NASA by TRW Space & Electronics Group, carries instrumentation developed by Orbital Sciences to map the development, extent and trends of the ozone depletion occurring in the atmosphere.

A prelaunch news conference will be carried live on NASA Television on Friday, June 28 at 11:30 a.m. PDT in the conference room of the NASA-KSC Resident Office at Vandenberg Air Force Base. Participating in the briefing will be:

- Floyd Curington, NASA Launch Manager, Kennedy Space Center
- Larry Mataosky, Pegasus Launch Services Manager, Goddard Space Flight Center
- J.R. Thompson, General Manager, Launch Systems Group Orbital Sciences Corporation

-more-

- Art Azarbarzin, TOMS Mission Director, Goddard Space Flight Center
- Dr. P.K. Bhartia, TOMS Project Scientist Goddard Space Flight Center
- Lt. Mike Mills, Launch Weather Officer, USAF 30th Weather Squadron Vandenberg Air Force Base

Immediately following the prelaunch news conference a TOMS mission science briefing will be held. Participating in the briefing will be Dr. P.K. Bhartia, TOMS Project Scientist and Art Azarbarzin, TOMS Mission Director.

Media wishing to cover the prelaunch news conference and mission science briefing should meet at the south gate of Vandenberg Air Force Base on California State Road 246 at 11 a.m. PDT for escort to the NASA-KSC Vandenberg Resident Office.

On Friday, June 28 at 12:30 p.m. PDT immediately following the prelaunch briefings, a van will depart from the NASA-KSC Vandenberg Resident Office for a tour by Orbital Sciences Corp. of the Pegasus processing facility and the L-1011 aircraft with the Pegasus/TOMS vehicle attached. There also will be a tour of NASA's central telemetry facility where flight data from the Pegasus vehicle will be monitored.

Media wishing accreditation information should contact the Air Force at:

Public Affairs Office
Vandenberg Air Force Base
Telephone: 805/734-8232, Ext. 6-3595
FAX: 805/734-8232, Ext. 6-8303
E-mail: pubaffairs@plans.vafb.af.mil

Pegasus/TOMS access badges will be issued upon entry to Vandenberg AFB and will be valid for the prelaunch news conference and other activities on L-1 day. This badge also will be valid for access to cover the launch activities.

On launch day, media representatives should meet at the Vandenberg main gate at 11 p.m. PDT to be escorted to the runway for the takeoff of the L-1011. After departure, media will be taken to the viewing room of the NASA Mission Director's Center located at Building 840 on South Vandenberg AFB. From there, media may follow the deployment and launch of Pegasus/TOMS. Following launch, vehicle and spacecraft representatives will be available to informally answer questions from the media.

Since countdown and launch will occur in darkness, there will be no live coverage on NASA Television. However, live launch commentary and audio of all Pegasus/TOMS briefings will be available on the "V-2" and "V-3" audio circuits which may be dialed directly at 407/867-1240 or 407/867-1260.

-more-

NASA Television will cover the TOMS mission by the following schedule:

June 28 11:30 a.m. PDT: Pegasus/TOMS prelaunch news conference
June 28 12:00 Noon PDT: TOMS mission science briefing
June 28 11:30 p.m. PDT: launch commentary begins with L-1011 departure and concludes after spacecraft separation approximately 90 minutes later (audio only)
June 29 12:30 p.m. PDT: NASA TV replay of countdown and launch highlights

NASA Television is available on Spacenet 2, Transponder 5, channel 9 located at 69 degrees West longitude.

The Pegasus/TOMS News Center at the NASA-KSC Vandenberg Resident Office will be staffed starting two days before launch and may be reached between 8 a.m. and 5 p.m. PDT at 805/734-8232, Ext. 5-3051. A recorded status report also will be available beginning on L-2 days by dialing 805/734-8232, Ext. 5-3456.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

Don Savage
Headquarters, Washington, DC
(Phone: 202/358-1547)

Mary Beth Murrill
Jet Propulsion Laboratory, Pasadena, CA
(Phone: 818/354-5011)

June 24, 1996

RELEASE: C96-e

CONTRACTS AWARDED FOR SPACE INFRARED TELESCOPE FACILITY

NASA today awarded three new contracts toward development of the $443 million Space Infrared Telescope Facility (SIRTF), a high-priority astrophysics mission to explore the birth and evolution of the universe, planned for launch as early as 2001.

Lockheed-Martin Missiles and Space of Sunnyvale, CA, and Ball Aerospace & Technologies Corp. of Boulder, CO, were chosen to team with NASA's Jet Propulsion Laboratory (JPL), Pasadena, CA, to design, develop, test and integrate SIRTF. JPL manages the SIRTF project for NASA's Office of Space Science, Washington, DC.

Ball was chosen to design and develop the cryogenic telescope assembly. Lockheed-Martin was selected to provide the SIRTF spacecraft, and, under a separate contract, to perform SIRTF's system-level integration and test.

The contracts are collectively valued at about $160 million, with $20 million allotted for definition work (Phase B) beginning in October 1996 and continuing for 18 months. Another $140 million would be provided for work during the project's design and development period (Phase C/D), pending Congressional approval in Fiscal Year 1998.

"SIRTF is a major step forward in the design of infrared astronomical space observatories," said Dr. Frank Giovane, SIRTF Program Executive, NASA Headquarters. "It incorporates the most advanced detector and telescope technology, the result of years of research by American industry. Consequently, SIRTF will far exceed the capabilities of previous infrared telescopes, and I believe it will make major advances in our understanding of the universe."

- more -

Some of SIRTF's innovations include a unique solar orbit (trailing the Earth as it moves around the Sun), state-of-the-art infrared technology, a new lightweight cryogenic telescope made entirely of beryllium, and a cost-saving telescope cooling system that reduces the amount of cryogen that will be used to maintain the low temperatures required for sensitive infrared observations.

SIRTF has been designated as the highest-priority major mission for all U.S. astronomy in the 1990s by the National Academy of Sciences, and for more than a decade has been recognized as a key element in the NASA astrophysics program. "In that time, SIRTF has undergone radical redesign to meet challenging cost constraints and to be consistent with the new NASA paradigm of faster, better, cheaper," said Larry Simmons, SIRTF Project Manager at JPL.

Rather than award a single contract for development of SIRTF, the contracts were awarded in three specialized areas. "We've broken the contracts into three parts to allow us to form the best possible team to develop the overall observatory using the new concept of an integrated project team rather than the historical systems contractor approach," said Simmons.

Plans call for SIRTF's initial development activity to take place at JPL with representatives from each of the contractor teams in residence for the early systems definition period through completion of the project's requirements review.

"Our expectation is that having a NASA/JPL/contractor team assume responsibility for SIRTF will enable us to complete the most capable infrared facility possible within SIRTF's fixed budget," Simmons said.

Astronomers will use SIRTF to explore the infrared universe with a depth and precision complementary to that achieved by NASA's other Great Observatories -- the Hubble Space Telescope, (HST), the Advanced X-ray Astrophysics Facility (AXAF), and the Compton Gamma Ray Observatory (CGRO). SIRTF's planned launch in 2001 would permit overlapping, synergistic observations with both HST and AXAF.

The mission also will provide key data to NASA's new Origins program -- a multifaceted research endeavor to learn the origins of galaxies, stars, planets and the universe as a whole, and to search for Earth-like planets around nearby stars.

The SIRTF World Wide Web Home Page is located on the Internet at: http://sirtf.jpl.nasa.gov/sirtf/home.html.

- end -

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

June 24, 1996

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Headquarters, Washington, DC
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(Phone: 713/483-5111)

NOTE TO EDITORS: N96-42

MIR 22 PRELAUNCH NEWS CONFERENCE SET

The next group of cosmonauts to occupy the Russian Mir Space Station, including U.S. astronaut John Blaha, will discuss their mission in a prelaunch news conference at 9 a.m. EDT, Wednesday, June 26, from the Gagarin Cosmonaut Training Center in Star City, Russia.

The news conference can be viewed on NASA Television, however no question and answer capability will be available for reporters at NASA centers.

Mir 22 Commander Gennady Manakov and Flight Engineer Pavel Vinogradov are scheduled to be launched in a Soyuz TM-24 capsule from the Baikonur Cosmodrome in Kazakhstan on August 14 and will dock to the Mir on August 16 to begin what is expected to be a six-month mission. Blaha will already be aboard Mir, having been transported to the space station aboard the Shuttle Atlantis on the STS-79 mission, which is tentatively scheduled for launch July 31. Blaha will spend about four months on Mir, replacing astronaut Shannon Lucid, who has been part of the Mir 21 crew since March. Lucid will return to Earth around August 9 with the STS-79 crew.

NASA Television is carried on C-band, Spacenet 2, Transponder 5, Channel 9 at 69 degrees West longitude. The transponder frequency is 3880 Mhz and the audio subcarrier is 6.8 Mhz.

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News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

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Headquarters, Washington, DC
(Phone: 202/358-1753)

Mary Beth Murrill
Jet Propulsion Laboratory, Pasadena, CA
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For Release

June 24, 1996

RELEASE: 96-122

GALILEO READY FOR CLOSE FLYBY OF JUPITER'S BIGGEST MOON

Now residing in orbit around Jupiter, NASA's Galileo spacecraft is primed for its first close flyby of Jupiter's largest moon, Ganymede, at 2:29 a.m. EDT on June 27, 1996.

Equipped with 10 scientific instruments, Galileo will fly just 524 miles above Ganymede's surface to provide the most detailed images and other information ever obtained about the icy satellite. Galileo will be 70 times closer to Ganymede than Voyager 2 and 133 times closer than Voyager 1. Images and other data gathered by the spacecraft will be radioed back to Earth in the hours and months following the flyby.

On June 23, Galileo's particle detectors and magnetic fields instruments began making nearly continuous measurements as the spacecraft approached Ganymede. Its optical instruments will shortly begin their periodic observations, including the first round of picture-taking (other than engineering images taken for navigation purposes) since months before the spacecraft entered orbit around Jupiter on Dec. 7, 1995.

If spacecraft operations near Ganymede and the subsequent transmission to Earth of initial science data occur as planned, selected images of Ganymede taken by Galileo will be released in a televised news conference at the Jet Propulsion Laboratory, Pasadena, CA, tentatively scheduled for July 10.

With a diameter of 3,269 miles, Ganymede is the largest moon in the Solar System -- bigger than Mercury and about three-quarters the size of Mars. It possesses a variety of familiar Earth-like geologic formations including craters and basins, grooves and mountains. The bulk of the satellite is believed to be about half water-ice and half rock. Portions of its surface are relatively bright, clean ice while the other regions are covered with darker "dirty" ice. The darker areas appear to be ancient and heavily cratered, while the lighter regions display evidence of tectonic activity that may have broken up the icy crust. A thin layer of ozone has been found in Ganymede's surface by Earth-based astronomers.

-more-

Galileo will return high-resolution images showing features on Ganymede as small as 33 feet across. Instruments on board will assess Ganymede's surface chemistry and search for signs of an atmosphere around the big moon. Measurements will be made to characterize Ganymede's gravity field and to determine if it possesses a magnetic field.

In the days just before and after the Ganymede flyby, Galileo's other studies will include a search for auroral activity on Jupiter's nightside and observations of other Jovian moons: Io, Europa and Callisto. The "Io torus," a hot, doughnut-shaped ring of charged particles swirling about Jupiter at Io's distance, will be another target of study, as will Jupiter's Great Red Spot.

Galileo's Ganymede encounter marks the start of a steady stream of data to be returned to Earth by Galileo's instruments throughout the course of its two-year tour of the Jovian system, which continues through December 1997. Beginning in July, data return will include an average of two to three images per day.

The remainder of Galileo's mission is to complete 11 orbits of Jupiter, conducting multiple close flybys of the moons Ganymede, Europa and Callisto, with numerous, more distant studies of the moon Io also scheduled throughout the tour. Studies of Jupiter itself are planned throughout the tour, and nearly continuous studies of Jupiter's enormous radiation and magnetic fields will be conducted.

The fifth planet from the Sun is known primarily for the banded appearance of its upper atmosphere and its centuries-old Great Red Spot, a massive, hurricane-like storm as big as three Earths. Jupiter generates the biggest and most powerful planetary magnetic field, and it radiates more heat from internal sources than it receives from the Sun.

Given its large size and its many natural satellites, Jupiter is often described as a miniature solar system. Jupiter has 318 times more mass and 1,400 times more volume than Earth, but is only 1/4th as dense, since it is composed primarily of hydrogen and helium. It is orbited by at least 16 moons (and Galileo -- its first artificial satellite).

The 2-1/2-ton Galileo orbiter spacecraft was launched aboard Space Shuttle Atlantis on Oct. 18, 1989. It carries the most capable payload of scientific experiments ever sent to another planet.

Communications to and from Galileo are conducted through NASA's Deep Space Network, using tracking stations in California, Spain and Australia. An innovative combination of new, specially developed software for Galileo's on-board computer and improvements to ground-based signal receiving hardware in the Deep Space Network will enable the spacecraft to accomplish at least 70 percent of its original mission science goals using only its small, low-gain antenna, despite the failure of its high-gain antenna to unfurl properly in April 1991.

NASA's Jet Propulsion Laboratory built the Galileo orbiter spacecraft and manages the overall mission. Galileo's atmospheric probe, which plunged into the planet on Dec. 7, 1995, was managed by NASA's Ames Research Center, Mountain View, CA.

Additional information on the Galileo mission and its results can be found on the World Wide Web at:

http://newproducts.jpl.nasa.gov/galileo/

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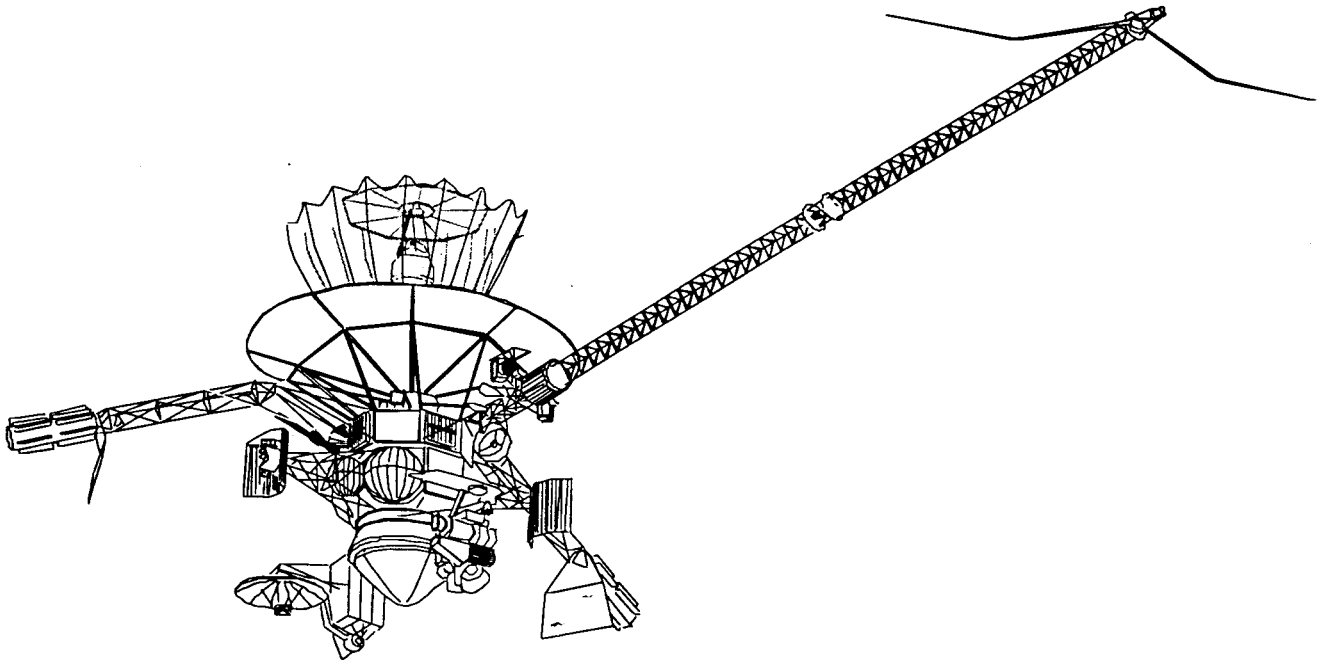
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

96-122

GALILEO AT JUPITER: THE FIRST GANYMEDE ENCOUNTER

PRESS KIT
JULY 1996



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Equipped with 10 scientific instruments, Galileo flew just 835 kilometers (519 miles) above Ganymede's surface to provide the most detailed images and other information ever obtained about the icy satellite. Images and other data gathered by the spacecraft have been radioed back to Earth in the days following the flyby, and will continue for several weeks this summer.

On June 23, Galileo's particle detectors and magnetic fields instruments began making nearly continuous measurements as the spacecraft approached Ganymede. Its optical instruments then began periodic observations, including the first round of picture-taking (other than engineering images taken for navigation purposes) since months before the spacecraft entered orbit around Jupiter on December 7, 1995.

Selected images of Ganymede taken by Galileo will be released in a televised news conference at the Jet Propulsion Laboratory on July 10.

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Galileo will return high-resolution images showing features on Ganymede as small as 10 meters (about 33 feet) across. Instruments on board have assessed Ganymede's surface chemistry and searched for signs of an atmosphere around the big moon. Measurements have been made to characterize Ganymede's gravity field and to determine if it possesses a magnetic field.

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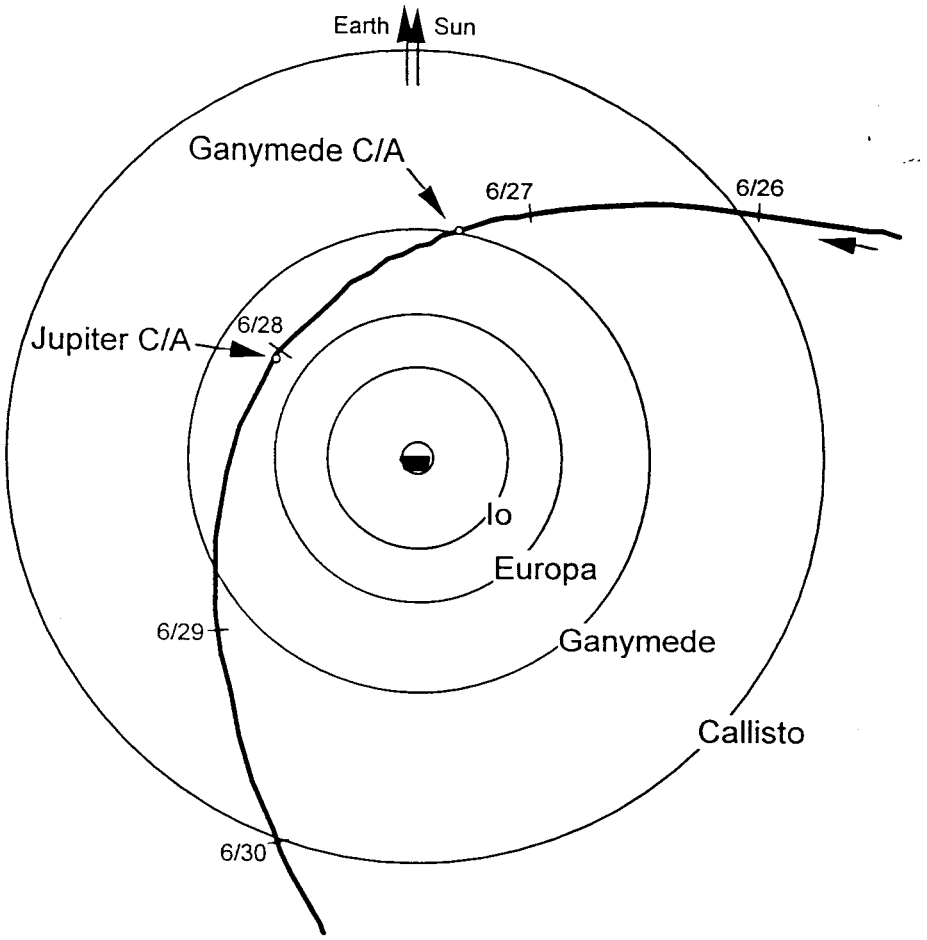

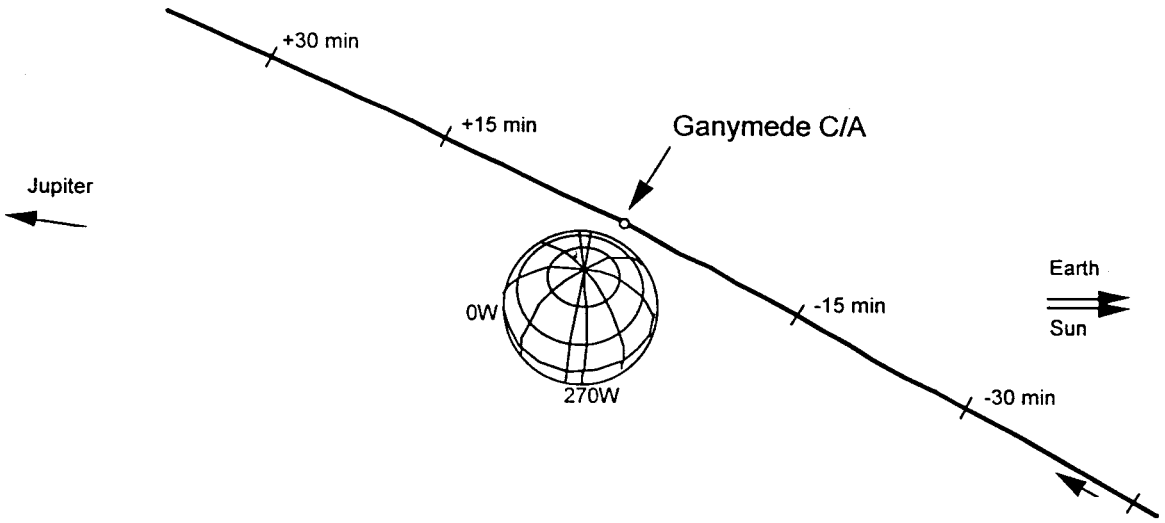

Media Services Information

NASA Television Transmission

NASA Television is available through the Spacenet 2 satellite on transponder 5, channel 9, 69 degrees west longitude, frequency 3880 MHz, audio subcarrier 6.8 MHz, horizontal polarization. The schedule for coverage of television transmissions during the Galileo mission is available from the Jet Propulsion Laboratory, Pasadena, CA; Ames Research Center, Mountain View, CA; Kennedy Space Center, FL; and NASA Headquarters, Washington, DC.

Status Reports

Status reports on Galileo mission are issued by the Jet Propulsion Laboratory's Public Information Office. They may be accessed online as noted below.

Briefings

On July 10, 1996 at 10 a.m. PDT (1 p.m. EDT), preliminary science results from the Ganymede encounter will be featured in a NASA Space Science Update originating at the Jet Propulsion Laboratory and televised live on NASA TV (see NASA TV information above).

Internet Information

Extensive information on the Galileo mission, including an electronic copy of this press kit, press releases, fact sheets, status reports and images, is available from the Jet Propulsion Laboratory's World Wide Web home page at **http://www.jpl.nasa.gov**. In addition to offering such public affairs materials, the JPL home page links to the Galileo Project's Web home page, **http://www.jpl.nasa.gov/galileo**, which offers additional information on the mission.

The general JPL site may also be accessed via Internet using anonymous file transfer protocol (FTP) at the address **ftp.jpl.nasa.gov**. Users should log on with the username "anonymous" and enter their E-mail address as the password. For users without Internet access, the site may additionally be accessed by modem at 818/354-1333.

Quick Look Facts: Galileo Mission

A note about the times used here: Because of Jupiter's great distance, a speed-of-light radio transmission from Galileo takes from 35 minutes to nearly one hour to reach receivers on Earth. The one-way light time is shortest when the spacecraft is closer to Earth at it orbits Jupiter, and longest when the spacecraft is more distant. The Galileo spacecraft event times used below are all Earth-received times. On arrival day, Galileo's one-way light time was approximately 52 minutes. During the Ganymede flyby, the one-way light time will be approximately 37 minutes.

Launch and deployment: STS-34 Atlantis and IUS	October 18, 1989
Venus flyby (about 16,000 km/9,500 mi)	February 10, 1990
Earth 1 flyby (about 1,000 km/620 mi)	December 8, 1990
Asteroid Gaspra flyby (about 1,600 km/950 mi)	October 29, 1991
Earth 2 flyby (about 300 km/190 mi)	December 8, 1992
Asteroid Ida flyby (about 2,400 km/1,400 mi)	August 28, 1993
Probe release	July 12, 1995 11:07 p.m. PDT
Jupiter arrival (probe and orbiter)	December 7, 1995
Io flyby (about 1,000 km/620 mi)	December 7, 1995 10:38 a.m. PST
Probe atmospheric entry and relay	December 7, 1995 2:56 p.m. PST
Probe mission duration:	57 minutes
Jupiter Orbit Insertion (JOI):	December 7, 1995 5:19 p.m. PST

Jupiter moon encounters:

Io: Dec. 7, 1995 (Only magnetic fields and particle data were taken at this opportunity; no imaging or spectral data)

Ganymede: June 27. 1996 and Sept. 6, 1996; April 5, 1997; May 7, 1997

Callisto: November 4, 1996; June 25, 1997; Sept. 17, 1997

Europa: Dec.19, 1996; Feb. 20 and Nov. 6, 1997

Galileo End of Mission:	December 7, 1997

Galileo's Scientific Highlights at Jupiter to Date:

From the atmospheric probe:

- Jupiter's balance of hydrogen and helium unexpectedly like that of the Sun
- Wind speeds higher than estimated
- Jupiter hotter and much drier than expected

From the orbiter:

- Io has a giant metallic core
- Io probably has a magnetic field
- Huge trail of dust across solar system traced to Io

Mission Cost	$1.35 billion plus international contribution estimated at $110 million.

Quick Look Facts (continued)

Jupiter's Satellites

Name	Discovery	Mean dist. to Jupiter, km.	Period, days	Radius, km.	Notes
Metis	Voyager, 1979	127,960	0.3	(20)*	
Adrastea	Voyager, 1979	128,980	0.3	12 x 8	
Amalthea	Barnard, 1892	181,300	0.5	135 x 75	
Thebe	Voyager, 1979	221,900	0.7	(50)	
Io	Galileo, 1610	421,660	1.8	1,815	density 3.57**; volcanic
Europa	Galileo, 1610	670,900	3.5	1,569	density 2.97**; icy crust
Ganymede	Galileo, 1610	1,070,000	7.2	2,631	density 1.94**; deep ice crust
Callisto	Galileo, 1610	1,883,000	16.7	2,400	density 1.86**; deep ice crust
Leda	Kowal, 1974	11,094,000	239	(8)	long, tilted elliptical orbit
Himalia	Perrine, 1904	11,480,000	250	(90)	in "family" with Leda
Lysithea	Nicholson, 1938	11,720,000	259	(20)	in Leda "family"
Elara	Perrine, 1905	11,737,000	260	(40)	in Leda "family"
Ananke	Nicholson, 1951	21,200,000	631	(15)	retrograde in long, highly tilted, elliptical orbit
Carme	Nicholson, 1938	22,600,000	692	(22)	in "family" with Ananke
Pasiphae	Melotte, 1908	23,500,000	735	(35)	in Ananke "family"
Sinope	Nicholson, 1914	23,700,000	758	(20)	in Ananke "family"

* Radius numbers in parentheses are uncertain by more than 10%
**Density is in grams per cubic centimeter (water's density is 1)

Jupiter's Rings

Inner "Halo" ring, about 100,000 to 122,800 kilometers from Jupiter's center.
"Main" ring, 122,800-129,200 kilometers from center.
Outer "Gossamer" ring, 129,200 to about 214,200 kilometers.
Note that satellites Metis, Adrastea and Amalthea orbit in the outer part of the ring region.
The jovian satellites are named for Greek and Roman gods. Names of new moons are conferred by the International Astronomical Union.

Galileo Orbiter and Jupiter Atmospheric Probe

	Orbiter	Probe
Mass, kilograms (pounds)	2,223 (4,890)	339 (746)
Usable propellant mass	925 (2,035)	--
Height	6.15 m (20.5 ft)	86 cm (34 in.)
Instrument payload	12 experiments	7 experiments
Payload mass, kg (lb)	118 (260)	30 (66)
Electric power	Radioisotope thermoelectric generators (570-470 watts)	Lithium-sulfur battery, 730 watt-hours

Shuttle Atlantis (STS-34) Crew (Johnson Space Center)
Donald E. Williams, Commander
Michael J. McCulley, Pilot
Shannon W. Lucid, Mission Specialist
Franklin R. Chang-Diaz, Mission Specialist
Ellen S. Baker, Mission Specialist

Galileo Management

Galileo Project (Jet Propulsion Laboratory)
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Neal E. Ausman, Jr., Mission Director
Matthew R. Landano, Deputy Mission Director
Dr. Torrence V. Johnson, Project Scientist

Atmospheric Probe (Ames Research Center)
Marcie Smith, Probe Manager
Dr. Richard E. Young, Probe Scientist

Galileo Program (NASA Headquarters)
Donald Ketterer, Program Manager
Dr. Jay Bergstralh, Program Scientist
Dr. Wesley Huntress Jr., Associate Administrator for Space Science

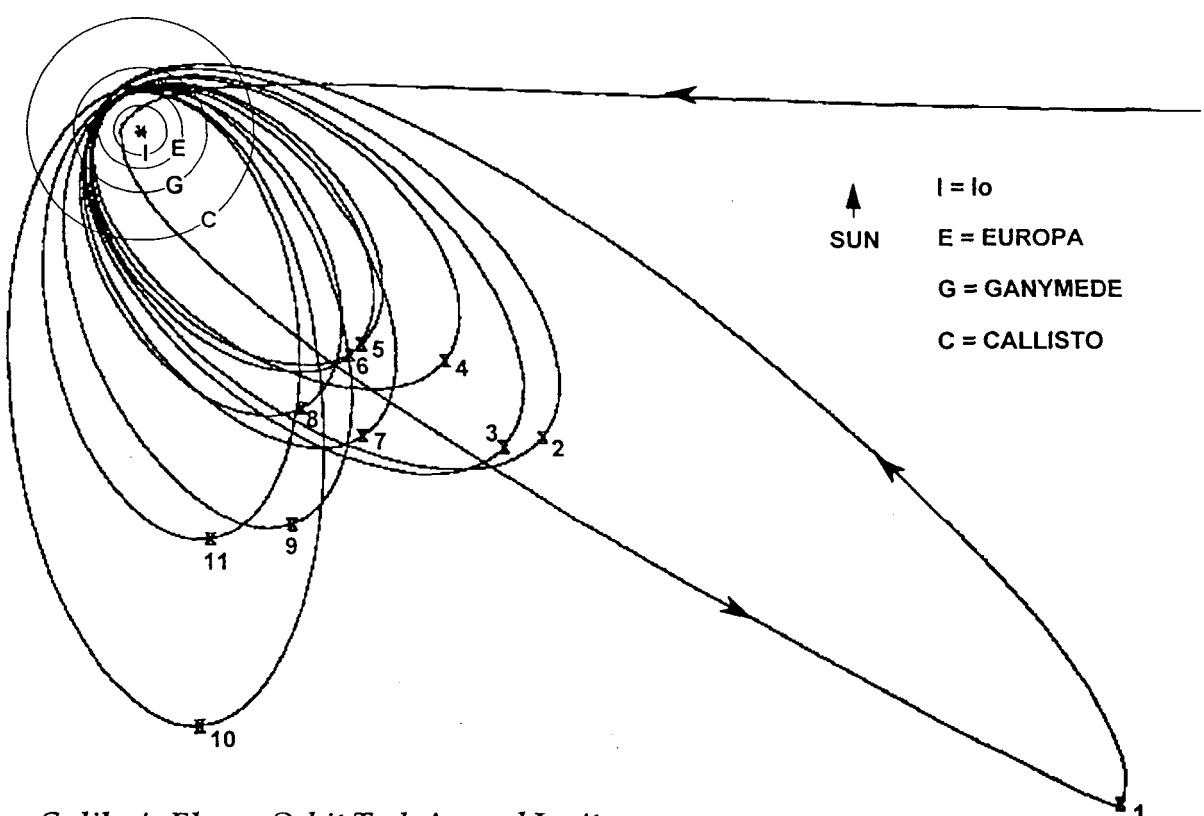
Orbiter Mission

Galileo's two-year orbital tour of the Jovian system is an elaborate square dance requiring the spacecraft to swing around one moon to reach the next. The June 27 encounter of Ganymede is the first of these satellite swingbys. It will shorten and change the shape of Galileo's ensuing orbit.

Each time the orbiter flies closely past one of the major inner moons, Galileo's course will be changed due to that satellite's gravitational effects. Careful targeting allows each flyby to direct the spacecraft on to its next satellite encounter and the spacecraft's next orbit around Jupiter.

Over the course of its two-year mission, Galileo will fly by Ganymede four times, Callisto three, and Europa three. Because of the dangerous, high-radiation environment where Io resides, Galileo could only fly closely past that volcanic moon once, on arrival day. Repeat passes through that neighborhood would likely have damaged the spacecraft's electronics.

Galileo's satellite encounters will be at altitudes as close as 200 kilometers (125 miles) above the surfaces of the moons, and typically 100 to 300 times closer than the Voyager flybys of the same moons.



Galileo's Eleven Orbit Trek Around Jupiter

The goals are to to determine the surface chemical composition, geological features and geophysical history of the four moons. Galileo's scanning instruments will scrutinize the surface and features of each. After a week or so of satellite observation, with its tape recorder full of data, the spacecraft will spend the next months in orbit playing out the information to Earth. Throughout the 23-month orbital tour, Galileo will continuously gather and return data on the dynamic Jovian magnetospheric and dust environment.

Galileo's Orbital Tour, 1995-1997

The spacecraft's orbital tour consists of 11 different elliptical orbits around Jupiter. Each orbit (except one) includes a close flyby and gravity assist at Ganymede, Callisto or Europa, near the inner (Jupiter) end of the orbit. The outer end of the orbit will vary from 5 to almost 20 million kilometers (3.2 to more than 12 million miles). No close flyby is planned for Orbit 5, when Galileo is out of communication due to solar conjunction -- the period when the Sun will be between Jupiter and Earth. Distant scientific encounters with additional satellites are scheduled for a number of orbits, and the spacecraft will observe Io at medium range on every orbit.

Orbit	Satellite Encounter	Date	Altitude, km (miles)	
1	Ganymede	June 27, 1996	500	(300)
2	Ganymede	September 6	259	(161)
3	Callisto	November 4	1,102	(685)
4	Europa	December 19	693	(431)
(5)	(Solar conjunction)		(no close flyby)	
6	Europa	February 20, 1997	587	(365)
7	Ganymede	April 5	3,056	(1,899)
8	Ganymede	May 7	1,580	(982)
9	Callisto	June 25	416	(258)
10	Callisto	September 17	524	(326)
11	Europa	November 6	1,124	(698)

The Jovian System

Jupiter is the largest planet in the solar system. Its radius is 44,400 miles (71,500 kilometers), more than 11 times Earth's, and its mass is 318 times that of our planet. It is made mostly of light elements, principally hydrogen (81 percent) and helium (18 percent). Its atmosphere and clouds are deep and dense, and a significant amount of energy is emitted from its interior. It has no solid surface. Its gases become hotter and denser with increasing depth.

Early Earth-based telescopic observations showed bands and spots in Jupiter's atmosphere; one huge storm system, the Red Spot, has been seen to persist over three centuries. The light and dark bands and some of the spots have disappeared and reappeared over periods of many years, and as the quality of Jupiter observation has improved, so has the amount of variability seen in the clouds.

Atmospheric features were seen in greatly improved detail with the Pioneer and Voyager missions of the 1970's. The Voyager encounters in the spring and summer of 1979 allowed the observation of short-term variations in real time as Jupiter turned beneath the spacecraft's cameras. Astronomers using Earth-based infrared telescopes have recently studied the nature and vertical dynamics of deeper clouds, and the new Earth- and space-based telescopes observe Jupiter's atmospheric developments and climate changes, most notably during the Comet Shoemaker-Levy 9 impacts.

Sixteen Jovian satellites are known. The four largest, discovered by Galileo in 1610, are about the size of small planets, and were seen by Voyager's experimenters to have the varied terrain of small worlds. The innermost of these, Io, has active sulfurous volcanoes, discovered by Voyager 1 and further observed by Voyager 2, Earth-based infrared astronomy and the Hubble Space Telescope. Io and Europa are about the size and density of Earth's moon (3-4 times the density of water) and probably mostly rocky inside. Europa may also exhibit surface activity. Ganymede and Callisto, further out from Jupiter, are the size of Mercury but less than twice as dense as water; their interiors are probably about half ice and half rock, with mostly ice or frost surfaces which show distinct and interesting features.

Of the others, eight are in inclined, highly eccentric orbits far from the planet, and four (three discovered by the Voyager missions in 1979) are close to the planet. Voyager also discovered a thin ring system at Jupiter in 1979.

Jupiter has the strongest planetary magnetic field known; the resulting region of its influence, called the magnetosphere, is a huge teardrop-shaped bubble in the solar wind pointing away from the Sun. The inner part of the magnetically-constrained charged-particle belt is doughnut-shaped, but farther out it flattens into a disk. The magnetic poles are offset and tilted relative to Jupiter's axis of rotation, so the field appears to wobble around with Jupiter's rotation (about every 10 hours), sweeping up and down across the inner satellites and making waves throughout the magnetosphere.

Interplanetary Cruise Science

Galileo has already returned a wealth of surprising new information from the "targets of opportunity" it has observed on the way to Jupiter. Two first-ever asteroid encounters yielded close-up images of the asteroids Gaspra and Ida, and the extraordinary discovery of a moon (later named Dactyl) orbiting Ida.

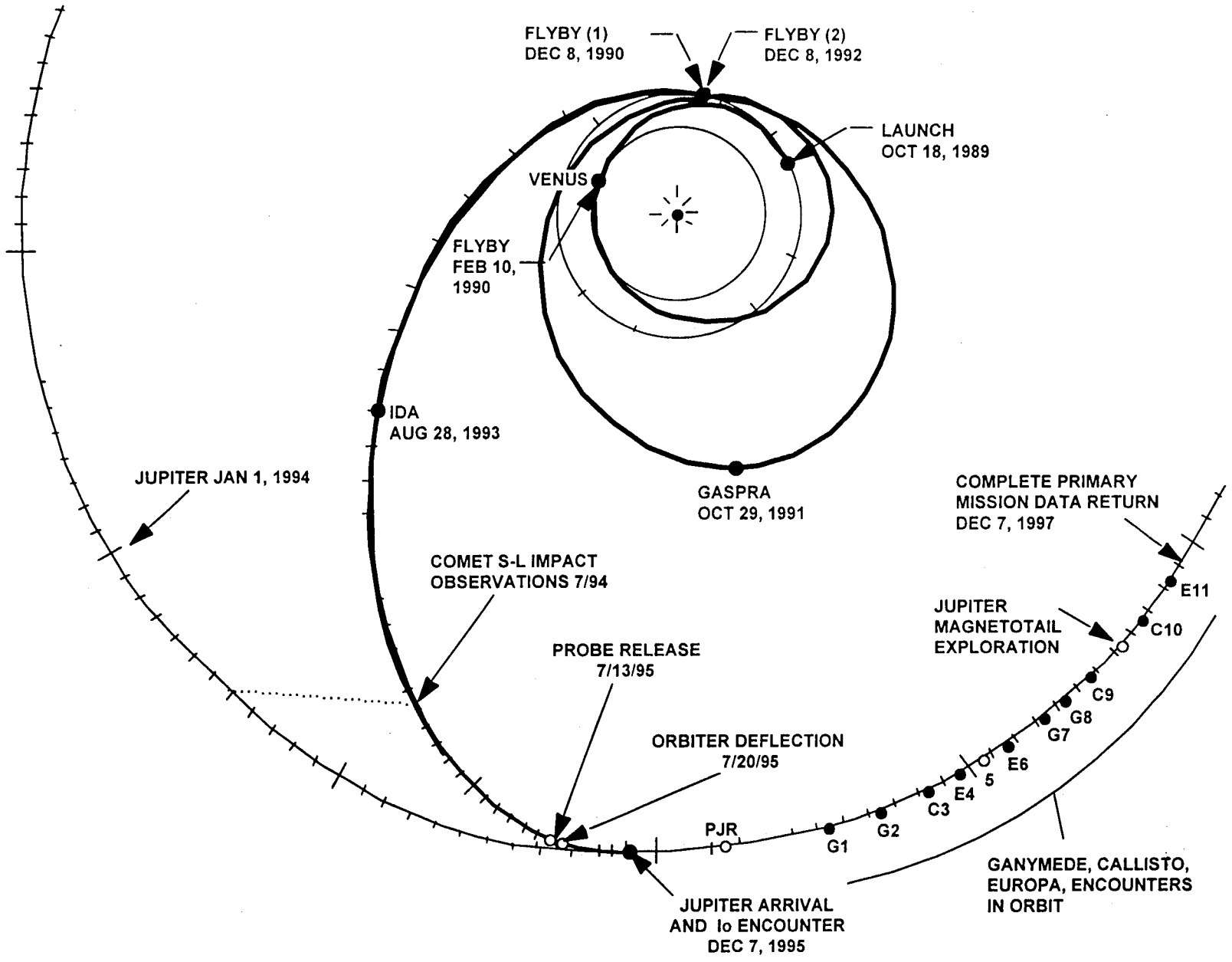
Lunar science

In 1992, Galileo revisited the north pole of the Moon explored by early spacecraft, imaging the region for the first time in infrared color and providing new information about the distribution of minerals on the lunar surface. The spacecraft flew within 68,000 miles (110,000 kilometers) of the Moon on Dec. 7, 1992, obtaining multispectral lunar images, calibrating Galileo's instruments by comparing their data to those of previous lunar missions, and getting additional baselines for comparing our Moon with the Jovian satellites Galileo will be exploring.

A major result of Galileo's first lunar flyby was the confirmation of the existence of a huge ancient impact basin in the southern part of the Moon's far side. The presence of this basin was inferred from Apollo data in the 1970s but its extent had never been mapped before. Galileo imaged the Moon's north pole at several different wavelengths (including infrared), a feat never before accomplished. Scientists found evidence that the Moon has been more volcanically active than researchers previously thought.

The near-infrared mapping spectrometer (NIMS) imaged the polar region in 204 wavelengths, another first in lunar mapping. The spacecraft also collected spectral data for dark mantle deposits, areas of local explosive volcanic eruptions. These maria deposits are more compositionally diverse toward the near side of the Moon. Specifically, scientists discovered that titanium is present in low to intermediate amounts toward the far side, suggesting that the far side has a thicker crust. This type of spectral data also allows scientists to determine the sequence of meteoric impacts and the thickness of ancient lava flows.

In observing the features of the Imbrium impact basin on the near side of the Moon, the imaging team found the Moon to have been more volcanically active earlier than previously thought. They found hidden maria, or "cryptomaria," are overlain by other features visible only through special



spectral bands. Nearly 4 billion years ago, the impact in the Imbrium basin threw out a tremendous amount of rock and debris that blanketed the Moon and caused erosion of the highland terrain. This blanketing and sculpture can be seen in Galileo's images of the north pole.

Gaspra

Nine months into its two-year Earth-to Earth orbit, Galileo entered the asteroid belt, and on Oct. 29, 1991, it accomplished the first-ever asteroid encounter. It passed about 1,600 kilometers (1,000 miles) from the stony asteroid Gaspra at a relative speed of about 8 kilometers per second (18,000 miles per hour); scientists collected pictures of Gaspra and other data on its composition and physical properties. These revealed a cratered, complex, and irregular body about 19 by 12 by 11 kilometers (12 by 7.5 by 7 miles), with a thin covering of dirt-like regolith and a possible magnetic field.

Ida

On Aug. 28, 1993, Galileo had a second asteroid encounter, this time with Ida, a larger, more distant body than Gaspra. There, Galileo made the discovery of the first moon of an asteroid. Ida is about 55 kilometers or 34 miles long; like Gaspra, it is very irregular in shape; it rotates every 4.6 hours around an offset axis. Apparently, like Gaspra, it may have a magnetic field.

The closest-approach distance was about 2,400 kilometers (1,500 miles), with a relative speed of nearly 12.6 kilometers per second or 28,000 miles per hour.

Ida's satellite, later named Dactyl, was found in a camera frame and an infrared scan. The 1.5-kilometer satellite was estimated to be about 100 kilometers (60 miles) from the center of the asteroid.

Comet Shoemaker-Levy

The discovery of Comet Shoemaker-Levy 9 in May 1993 provided an exciting new opportunity for Galileo's science team.

The Galileo spacecraft, approaching Jupiter, was the only observation platform capable of making measurements in line of sight to the comet's impact area on Jupiter's far side. Although there was no additional funding available for this new target of opportunity an observation program was planned for Galileo's remote sensing instruments. All of Galileo's observations had to be programmed in advance into the spacecraft computer, notwithstanding uncertainties in the predicted impact times. The data were stored on the spacecraft (one tape load plus some computer memory space) for playback at the 10 bits-per-second rate. Playback continued, with necessary interruptions for other activities, until late January 1995.

Galileo's imaging system used different methods to cover the time uncertainties (amounting to hours) of the impacts for different events. Repeated imaging, rather like a very slow motion picture, captured the very last impact (fragment W) which appeared to last 26 minutes. A smeared image, producing a streak representing the night-side impact fireball among smears showing Jupiter and some satellites, provided brightness histories of two events, the impact of fragments K and N. The photopolarimeter-radiometer detected three events. The infrared spectrometer detected two events, providing critical information on the size, temperature and altitude of the impact fireball and the heating of the atmospehre by the impact "fallback." Galileo scientists have combined their data to produce interpretive histories of the 90-second impact events.

Interplanetary Dust

In the summer of 1995, Galileo found itself flying through the most intense interplanetary dust storm ever measured. It was the largest of several dust storms encountered by Galileo since December 1994, when the spacecraft was still almost 110 million miles (about 175 million kilometers) from Jupiter. Galileo discovered that the volcanic moon Io is the source of the dust.

Scientists believe the particles emantating from Io are electrically charged and then accelerated by Jupiter's powerful magnetic field. Calculations indicate the dust is speeding through interplanetary space at between nearly 90,000 and 450,000 miles per hour (40 and 200 kilometers per second), depending on particle size. Even at such high speeds, these tiny particles pose no danger to the Galileo spacecraft because they are so tiny.

Atmospheric Probe Mission

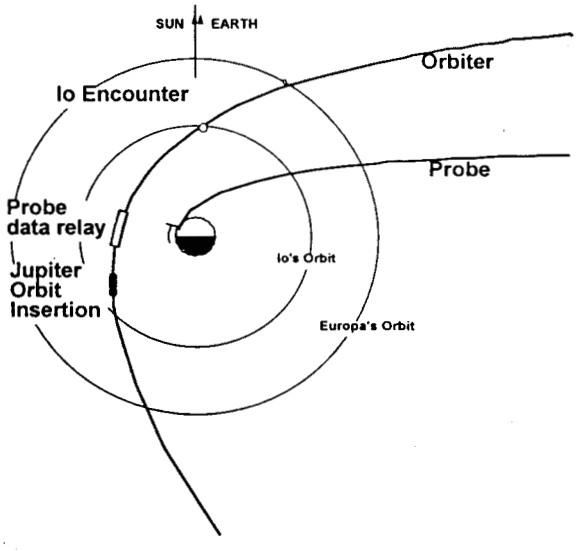
On July 13, 1995, the Galileo spacecraft spun up to 10 rpm and aimed its cone-shaped Jupiter atmospheric entry probe toward its Jupiter entry point 51 million miles (82 million kilometers) away. Guillotine-like cable cutters sliced though umbillicals connecting the two, and the probe was released from the main spacecraft for its solo flight to Jupiter.

On Dec. 7, 1995, the probe's descent into Jupiter provided the first-ever on-the-spot measurements of Jupiter or any other outer planet. Instruments on board identified the chemical components of Jupiter's atmosphere and their proportions, and searched for clues to Jupiter's history and the origin of the solar system.

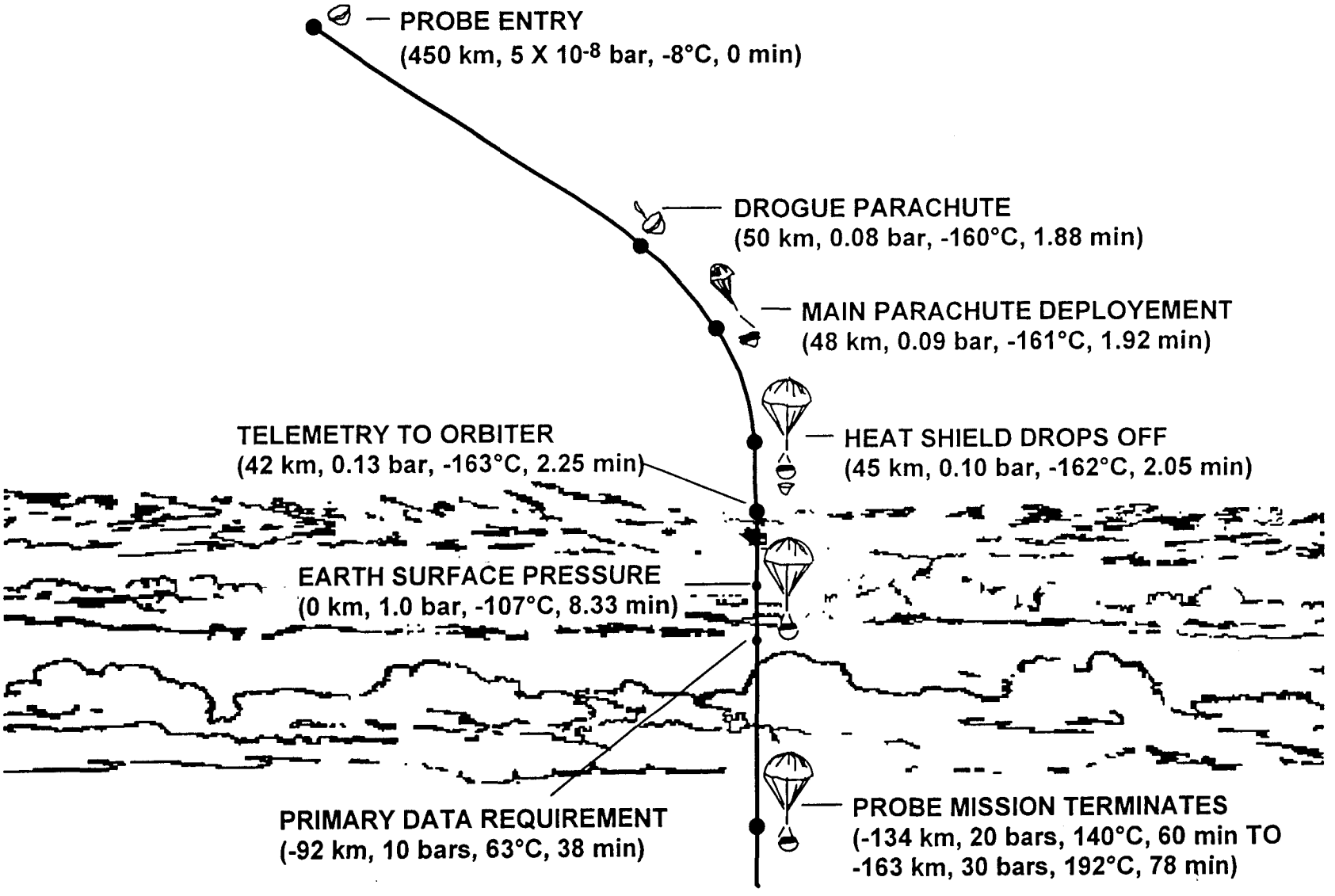
Six hours before entry the command unit signaled the probe to "wake up," and three hours later instruments began collecting data on lightning, radio emissions and charged particles.

The probe struck the atmosphere at an angle of only 8 degrees to the horizon -- steep enough so it wouldn't skip out again into space, yet shallow enough to survive the heat and jolting deceleration of entry. The probe entered the equatorial zone traveling the same direction as the planet's rotation.

During its entry, the incandescent gas cap ahead of the probe would have appeared as bright as the Sun to an observer and twice as hot (15,555 degrees Celsius or 28,000 degrees Fahrenheit) as the solar surface. With the exception of nuclear radiation, the probe's entry was like flying through a nuclear fireball. The probe was subjected to wrenching forces as it decelerated from 106,000 mph to 100 mph (about 170,000 to about 160 km per hour) in just two minutes -- a force estimated at up to 230 times Earth's gravity.



The Galileo orbiter, about 214,000 kilometers (133,000 miles) above, linked up with the probe's radio signal within 50 seconds. It received the probe's precious science-data transmissions and stored them both in the spacecraft tape recorder and in computer memory. Successful transmission of all the probe data was completed by April 1996.



Telecommunications Strategy

This spring, Galileo received the last of two long-distance electronic brain transplants that have endowed the spacecraft computers with new capabilities. The successful operation means Galileo can still achieve the majority of its scientific objectives despite the failure of its main communications antenna to open as commanded.

The upgrades to Galileo's on-board computer software and its ground-based communications hardware were developed and tested by JPL in response to what would have been a profound loss for the orbiter portion of the mission. (The spacecraft's Jupiter atmospheric probe mission could have been executed without the new techniques, but the upgrades did enhance the orbiter's ability to reliably record and re-transmit the probe data.)

The new telecommunications strategy now in use by the Galileo project hinges on more effective use of the spacecraft's low-gain antenna, which is limited to a very low data rate compared to the main, high-gain antenna.

The switch to the low-gain antenna and its lower data rate means that far fewer data bits will be returned from Jupiter. However, Galileo's new software increases its ability to edit and compress the large quantity of data collected and then transmit it to Earth in a shorthand form. New technology has also been used to greatly sharpen the hearing of the telecommunications equipment that receives Galileo's whisper of a signal from Jupiter. Together, these efforts should enable Galileo to fulfill at least 70 percent of its original scientific objectives.

The High-Gain Antenna

The 4.8-meter-wide (16-foot), umbrella-like high-gain antenna is mounted at the top of the spacecraft. When unfurled, the antenna's hosiery-like wire mesh stretches over 18 umbrella ribs to form a large parabolic dish. Galileo was to have used this dish to radio its scientific data from Jupiter. This high-performance, X-band antenna was designed to transmit data back to Earth at rates of up to 134,400 bits of digital information per second (the equivalent of about one imaging frame each minute).

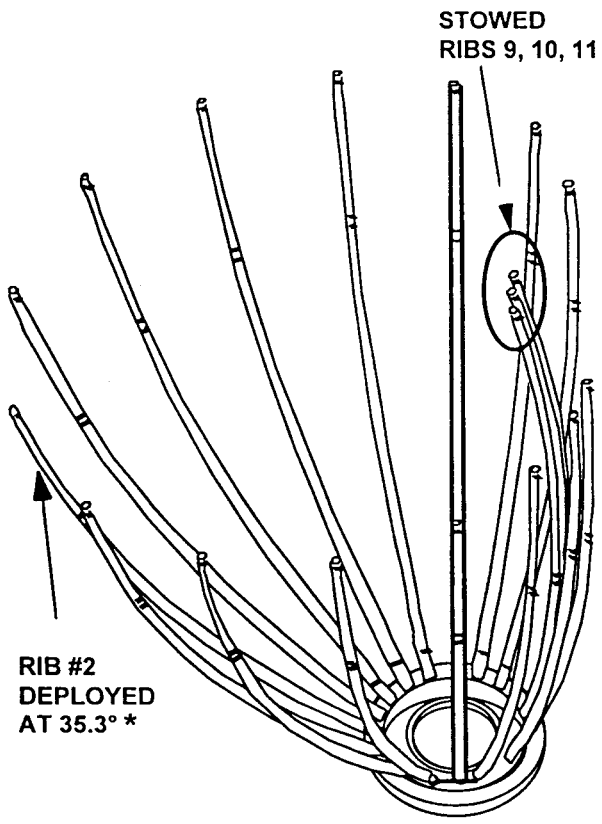
Galileo's original mission plan called for the high-gain antenna to open shortly after launch. For the Venus-Earth-Earth Gravity-Assist (VEEGA) trajectory mission, however, the heat-sensitive high-gain antenna had to be left closed and stowed behind a large sun shade to protect it during the spacecraft's passage through the inner solar system. During this portion of Galileo's journey, two small, heat-tolerant low-gain antennas provided the spacecraft's link to Earth. One of these S-band antennas, mounted on a boom, was added to the spacecraft expressly to bolster Galileo's telecommunications during the flight to Venus. The other primary low-gain antenna mounted to the top of the high-gain was destined to become the only means through which Galileo will be able to accomplish its mission.

The Antenna Problem

On April 11, 1991, after Galileo had traveled far enough from the heat of the Sun, the spacecraft executed stored computer commands designed to unfurl the large high-gain antenna. But telemetry received minutes later showed that something went wrong. The motors had stalled and the antenna had only partially opened.

In a crash effort over the next several weeks, a team of more than 100 technical experts from JPL and industry analyzed Galileo's telemetry and conducted ground testing with an identical spare antenna. They deduced that the problem was most likely due to the sticking of a few antenna ribs, caused by friction between their standoff pins and sockets.

The excessive friction between the pins and sockets has been attributed to etching of the surfaces that occurred after the loss of a dry lubricant that had been bonded to the standoff pins during the antenna's manufacture in Florida. The antenna was originally shipped to JPL by truck in its own special shipping container. In December 1985, the antenna, again in its own shipping container, was sent by truck to NASA's Kennedy Space Center (KSC) in Florida to await launch. After the Challenger accident, Galileo and its antenna had to be shipped back to JPL in late 1986. Finally, they were reshipped to KSC for integration and launch in 1989. The loss of lubricant is believed to have occurred due to vibration the antenna experienced during those cross-country truck trips.



* AFTER HAMMERING RIB #2 NOW AT 43°

Extensive analysis has shown that, in any case, the problem existed at launch and went undetected; it is not related to sending the spacecraft on the VEEGA trajectory or the resulting delay in antenna deployment.

Attempts to Free the Antenna

While diagnosis of the problem continued, the Galileo team sent a variety of commands intended to free the antenna. Most involved turning the space-craft toward and away from the Sun, in the hope that warming and cooling the apparatus would free the

stuck hardware through thermal expansion and contraction. None of these attempts succeeded in releasing the ribs.

Further engineering analysis and testing suggested that "hammering" the antenna deployment motors -- turning them on and off repeatedly -- might deliver the force needed to free the stuck pins and open the antenna. After more than 13,000 hammerings between December 1992 and January 1993, engineering telemetry from the spacecraft showed that additional deployment force had been generated, but it had not freed the ribs. Other approaches were tried, such as spinning the spacecraft up to its fastest rotation rate of 10 rpm and hammering the motors again, but these efforts also failed to free the antenna.

Project engineers believe the state of the antenna has been as well-defined as long-distance telemetry and laboratory tests will allow. After the years-long campaign to try to free the stuck hardware, the project determined there was no longer any significant prospect of the antenna being deployed.

Nevertheless, one last attempt was made in March 1996, after the orbiter's main engine was fired to raise Galileo's orbit around Jupiter. This "perijove raise maneuver" delivered the largest acceleration the experienced since launch, and it followed three other mildly jarring events: the release of the atmospheric probe, the orbiter deflection maneuver that follows probe release, and the Jupiter orbit insertion engine firing. These shocks, too, failed to jar the stuck ribs enough to free the antenna. This was the last attempt to open the antenna before radioing the new software to the spacecraft to inaugurate the advanced data compression techniques designed specifically for use with the low-gain antenna.

The Low-Gain Antenna

The difference between Galileo sending its data to Earth using the high-gain antenna and the low-gain is like the difference between the concentrated light from a spotlight versus the light emitted diffusely from a bare bulb. If unfurled, the high-gain would transmit data back to ground-based Deep Space Network (DSN) collecting antennas in a narrowly focused beam. The low-gain antenna transmits in a comparatively unfocused broadcast, and only a tiny fraction of the signal actually reaches DSN receivers. Because the received signal is 10,000 times fainter, data must be sent at a lower rate to ensure that the contents are clearly understood.

Without any new enhancements, the low-gain antenna's data transmission rate at Jupiter would be limited to only 8-16 bits per second (bps), compared to the high-gain's 134,400 bps. However, the innovative software changes, when coupled with hardware and software adaptations at Earth-based receiving stations, have increased the data rate from Jupiter by as much as 10 times, to 160 bps. The data compression methods allow retention of the most interesting and scientifically valuable information, while minimizing or eliminating less valuable data (such as the dark background of space in an image) before transmission. Two different methods of data compression will be used. In both methods, the data are compressed onboard the spacecraft before being transmitted to Earth.

The first method, called "lossless" compression, allows the data to be reformatted back to their original state once on the ground. This technique is routinely used in personal computer modems to increase their effective transmission rates. The second compression method is called "lossy," a term used to describe the dissipation of electrical energy, but which in this case refers to the loss of some original data through mathematical approximations used to abbreviate the total amount of data to be sent to the ground. Lossy compression will be used to shrink imaging and plasma wave data down to as little as 1/80th of its original volume.

Customizing Receivers on Earth

S-band telecommunication was once the standard for space missions, and several S-band performance-enhancing capabilities were implemented at DSN tracking stations in the 1980s. For Galileo and its S-band low-gain antenna, these capabilities have been restored at the Canberra, Australia, 70-meter antenna. Because Australia is in the southern hemisphere and Jupiter is in the southern sky during Galileo's tour, the Canberra complex receives most of Galileo's data.

Another critical, ongoing DSN upgrade has been the addition of so-called Block V receivers at the tracking stations. These receivers, which are being installed for multi-mission use, allow all of Galileo's signal power to be dedicated to the data stream by suppressing the traditional carrier signal, thus allowing use of higher data rates.

Finally, the 70-meter and two 34-meter DSN antennas at Canberra have been arrayed to receive Galileo's signal concurrently, with the received signals electronically combined. The arraying technique allows more of the spacecraft's weak signal to be captured, thereby enabling a higher data rate, which translates into the receipt of more data. In addition, other arraying is used for Galileo: the 64-meter Parkes Radio Telescope in Australia is arrayed with the Canberra antennas, as is the 70-meter DSN antenna in Goldstone, CA, when its view of Galileo overlaps with Canberra's.

The Tape Recorder Problem

Galileo's tape recorder is a key link in techniques developed to compensate for the loss of use of Galileo's high-gain antenna. The tape recorder is to be used to store information, particularly imaging data, until it can be compressed and edited by spacecraft computers and radioed via Galileo's low-gain antenna back to Earth.

On Oct. 11, 1995, with just weeks to go before Jupiter arrival, the tape recorder malfunctioned. Data from the spacecraft showed the recorder failed to cease rewinding after recording an image of Jupiter.

A week later, following extensive analysis, the spacecraft tape recorder was tested and proved still operational, but detailed study of engineering data indicates that the tape

recorder can be unreliable under some operating conditions. The problem appears to be manageable, however, and should not jeopardize return of the full complement of images of Jupiter and its moons that are to be stored on the recorder for playback over the course of the mission.

On Oct. 24, the spacecraft executed commands for the tape recorder to wind an extra 25 times around the section of tape involved in this anomaly. This section had been possibly weakened when the recorder was stuck in rewind mode for about 15 hours. Indications were that the tape had not moved during this entire time. The drive mechanisms had been slipping and possibly rubbing against the tape. Spacecraft engineers are uncertain about the condition of this area of tape so it is now "off-limits" for future recording. The extra tape wound over it secures that area of tape, eliminating any stresses that could tear the tape at this potential weak spot. Unfortunately, the approach image of Jupiter that Galileo took October 11, 1995 was stored on the off-limits portion of tape and will not be played back. More significantly, Galileo project officials also decided not to take pictures of Io and Europa on Dec. 7, 1995 in what would have been the closest encounter of Io (from a distance of 600 miles or 1,000 kilometers). Instead, the tape recorder was completely devoted that day to gathering data from Galileo's Jupiter atmospheric probe.

Engineers have continued to analyze the tape recorder's condition to fully understand its capabilities and potential weaknesses. Their goal has been to ensure safe operation of the tape recorder while minimizing loss of any of the objectives of the orbiter portion of the mission.

Very few of Galileo's original measurement objectives have had to be completely abandoned as a result of the high-gain antenna problem. For the most part, science investigations on the spacecraft have adapted to the lower data rates using a variety of techniques, depending on the nature of the experiment. The new software and DSN receiver hardware has increased the information content of the data Galileo returns by at least 100 times more than what would have been otherwise possible.

The onboard data processing made possible by the Phase 2 software now permits the spacecraft to store and transmit nearly continuous observations of the jovian magnetosphere and extensive spectral measurements of the planet and its satellites in the infrared, visible, and ultraviolet, including more than 1,500 high-resolution images.

While tens of thousands of images would be required for large-scale movies of Jupiter's atmospheric dynamics, the hundreds of images allocated to atmospheric imaging will allow in-depth study of several individual features in the clouds of Jupiter. Cooperative observations with Hubble Space Telescope investigators and ground-based observers has long been planned as part of the Galileo mission to provide information on the global state of Jupiter's atmosphere.

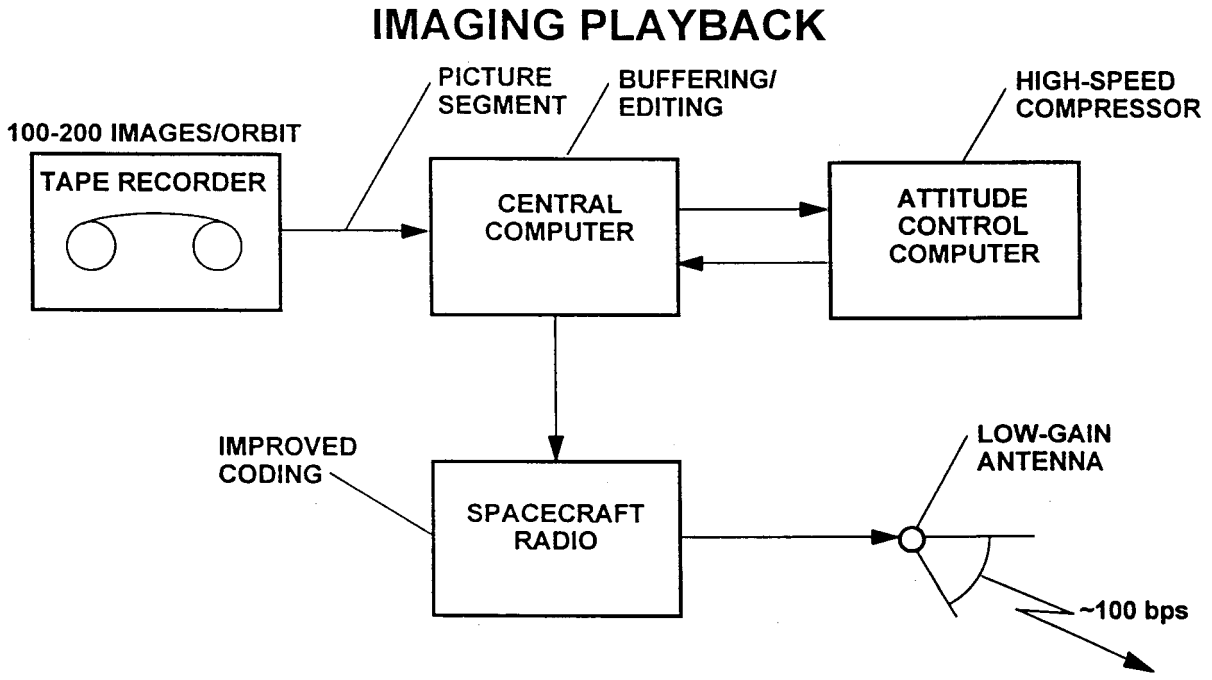
Like a tourist allotted one roll of film per city, the Galileo team has selected its observations carefully for each encounter to ensure that the maximum amount of new and

interesting scientific information is returned. The imaging campaign will focus on the planet and the four large Galilean moons, but it will also cover the four inner minor satellites and Jupiter's rings.

For the orbiter portion of the mission, it is useful to realize that Galileo, with its sophisticated instruments, closer satellite flybys, and long duration in Jovian orbit, was specifically designed to answer many of the questions that the Pioneer and Voyager spacecraft were unable to answer. None of those characteristics have been affected by the loss of the high-gain antenna: only the total volume of data has been reduced.

As a result, when Galileo examines a class of phenomena, fewer samples of that class can be studied, and often, the spectral or temporal resolution will be reduced to lessen the total volume of data. Nevertheless, the resulting information will provide unique insight into the jovian system.

Some specific impacts from the loss of the high-gain antenna include: elimination of color global imaging of Jupiter once per orbit; elimination of global studies of Jupiter's atmospheric dynamics such as storms, clouds, and latitudinal bands (efforts to image atmospheric features, including the Great Red Spot, are still planned, however); a reduction in the spectral and spatial coverage of the moons, which provided context for study of high-resolution observations of their key features; and reduction of much of the so-called fields and particles microphysics (requiring high temporal- and spectral-frequency sampling of the environment by all instruments) during the cruise portion of each orbit. Most of the fields and particles microphysics, however, will be retained during the satellite encounters.



Highlights of Jupiter Science Returned Via Galileo's Low-Gain Antenna:

- 100 percent of probe data (mission accomplished).
- Nearly continuous, real-time survey of jovian magnetosphere for two years
- Approximately 1,500 images of the four Galilean satellites, four inner minor satellites, Jupiter and its rings
- Ten very close encounters: Europa (3), Callisto (3) and Ganymede (4)
- Five Voyager-class (less than 80,000 km) encounters with Galilean satellites

Ground Systems and Spacecraft Operations

Galileo communicates with Earth via NASA's Deep Space Network (DSN), which has a complex of large antennas with receivers and transmitters located in the California desert, in Australia and in Spain, linked to a network control center at JPL in Pasadena, CA. The spacecraft receives commands, sends science and engineering data, and is tracked by doppler and ranging measurements through this network. Mission control responsibilities include commanding the spacecraft, interpreting the engineering and scientific data it sends in order to understand how it is performing and responding, and analyzing navigation data obtained by the Deep Space Network. The controllers use a set of complex computer programs to help them control the spacecraft and interpret the data.

The Galileo spacecraft carries out its complex operations, including maneuvers, scientific observations and communications, in response to stored sequences which are sent up to the orbiter periodically through the Deep Space Network in the form of command loads.

The spacecraft status and health are monitored through data from 1,418 onboard measurements. The Galileo flight team interprets these data into trends to avert or work around equipment failure. Their conclusions become an important input, along with scientific plans, to the sequence design process. The telemetry monitoring is supported by computer programs written and used in the mission support area.

Navigation is the process of estimating, from radio range and doppler measurements, the position and velocity of the spacecraft to predict its flight path and to design course-correcting maneuvers. These calculations must be done with computer support. The Galileo mission, with its complex gravity-assist flight to Jupiter and 10 gravity-assist satellite encounters in the Jovian system, is extremely dependent on consistently accurate navigation.

In addition to the programs which directly operate the spacecraft and are periodically transmitted to it, the mission operations team uses software amounting to 650,000 lines of programming code in the sequence design process; 1,615,000 lines in the telemetry interpretation; and 550,000 lines of code in navigation. These all had to be written, checked,

tested, used in mission simulations and, in many instrument cases, revised before the mission could begin.

Science investigators are located variously at JPL or at their home laboratories, linked by computer communications. From either location, they are involved in developing the sequences affecting their experiments and, in some cases, helping to change preplanned sequences to follow up on unexpected discoveries with second looks.

The Spacecraft

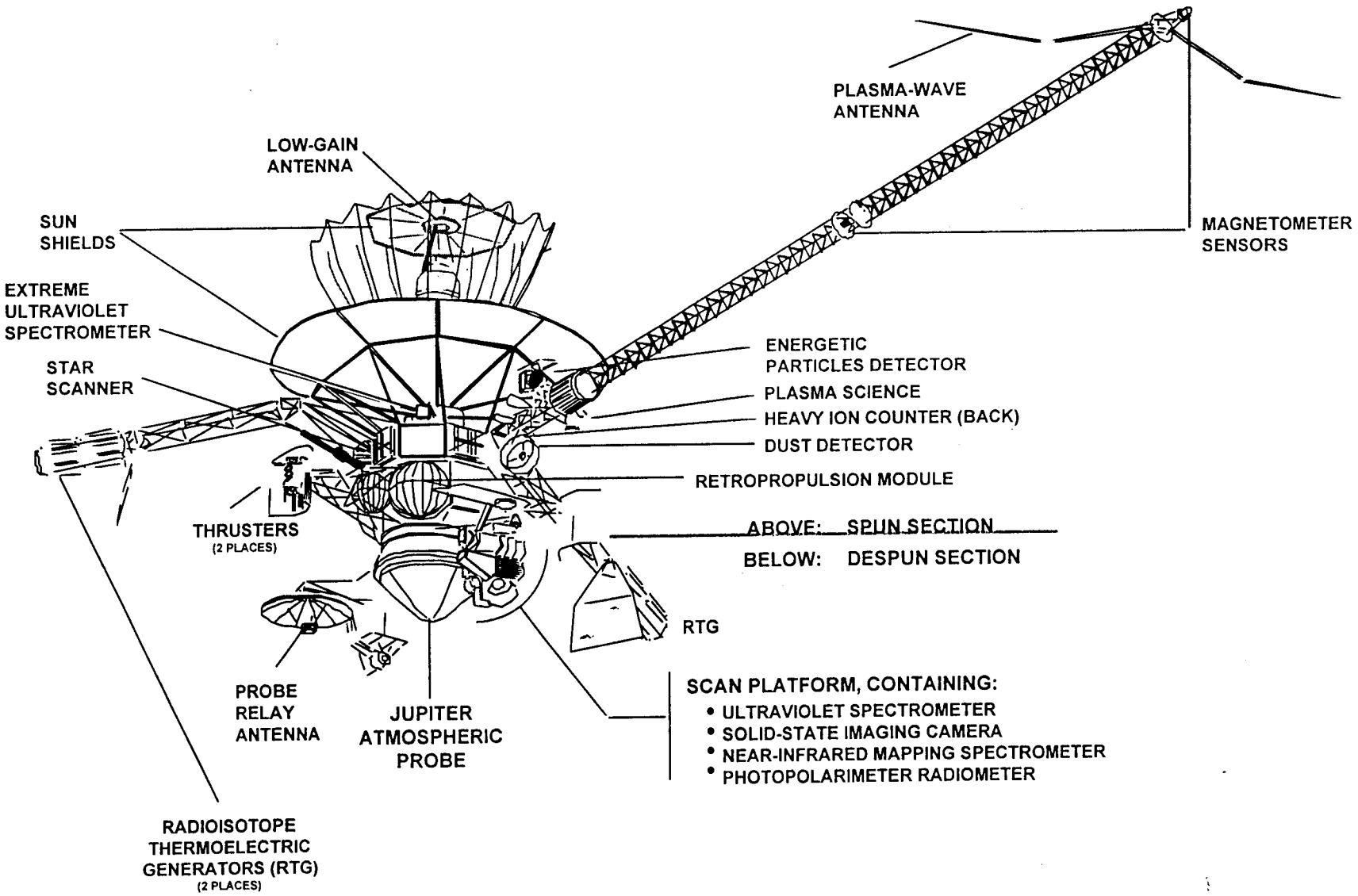
The Galileo mission and systems were designed to investigate three broad aspects of the Jovian system: the planet's atmosphere, the satellites and the magnetosphere. The spacecraft was constructed in three segments, which help focus on these areas: 1) the atmospheric probe; 2) a non-spinning section of the orbiter carrying cameras and other remote sensors; 3) the spinning main section of the orbiter spacecraft which includes the fields and particles instruments, designed to sense and measure the environment directly as the spacecraft flies through it. The spinning section also carries the communications antennas, the propulsion module, flight computers and most support systems.

This innovative "dual spin" design allows part of the orbiter to rotate constantly at three rpm, and part of the spacecraft to remain fixed. This means that the orbiter can easily accommodate magnetospheric experiments (which need to take measurements while rapidly sweeping about) while also providing stability and a fixed orientation for cameras and other sensors. The spin rate can be increased to 10 revolutions per minute for additional stability during major propulsive maneuvers.

Galileo's atmospheric probe weighed 339 kilograms (746 pounds), and included a deceleration module to slow and protect the descent module, which carried out the scientific mission.

The deceleration module consisted of an aeroshell and an aft cover, designed to block the heat generated by friction during the sharp deceleration of atmospheric entry. Inside the shells were the descent module and its 2.5-meter (8-foot) parachute. The descent module carried a radio-relay transmitter and six scientific instruments. Operating at 128 bits per second, each of the dual L-band transmitters sent nearly identical streams of scientific data to the orbiter. Probe electronics were powered by batteries with an estimated capacity of about 18 amp-hours on arrival at Jupiter.

Probe instruments included an atmospheric structure group of sensors measuring temperature, pressure and deceleration; a neutral mass spectrometer and a helium-abundance detector supporting atmospheric composition studies; a nephelometer for cloud location and cloud-particle observations; a net-flux radiometer measuring the difference, upward versus downward, in radiant energy flux at each altitude; and a lightning/radio-emission instrument with an energetic-particle detector, measuring light and radio emissions associated with lightning and energetic particles in Jupiter's radiation belts.



At launch, the orbiter weighed about 2,223 kilograms (4,900 pounds), not counting the upper-stage-rocket adapter but including about 925 kilograms of usable rocket propellant. This propellant was used in almost 30 relatively small maneuvers during the long gravity-assisted flight to Jupiter, three large thrust maneuvers including the one that put the craft into its Jupiter orbit, and will be used for the 30-some trim maneuvers planned for the rest of the mission. It is also consumed in the small pulses that turn and orient the spacecraft.

The propulsion module consists of twelve 10-newton thrusters, a single 400-newton engine, the monomethyl-hydrazine fuel, nitrogen-tetroxide oxidizer, and pressurizing-gas tanks, tubing, valves and control equipment. (A thrust of 10 newtons would support a weight of about one kilogram or 2.2 pounds at Earth's surface.) The propulsion system was developed and built by Messerschmitt-Bolkow-Blohm (MBB) and provided by Germany as a partner in Project Galileo.

In addition to the scientific data acquired by its 10 instruments, the Galileo orbiter acquires and can transmit a total of 1,418 engineering measurements of internal operating conditions including temperatures, voltages, computer states and counts. The spacecraft transmitters operate at S-band frequency (2,295 megahertz).

Two low-gain antennas (one pointed upward or toward the Sun, and one on a deployable arm to point down, both mounted on the spinning section) supported communications during the Earth-Venus-Earth leg of the flight. The top-mounted antenna is currently carrying the communications load, including science data and playbacks, in place of the high-gain antenna, and is the basis of the redesigned Jupiter sequences. The other low-gain antenna has been re-stowed after supporting operations during the early VEEGA phase, and is not expected to be used again.

Because radio signals take more than one hour to travel from Earth to Jupiter and back, the Galileo spacecraft was designed to operate using programs sent to it in advance and stored in spacecraft memory. A single master sequence program can cover from weeks to months of quiet operations between planetary and satellite encounters. During busy encounter operations, one program covers only about a week.

These sequences operate through flight software installed in the principal spacecraft computers. In the command and data subsystem software, there are about 35,000 lines of code, including 7,000 lines of automatic fault protection software, which operates to put the spacecraft in a safe state if an untoward event such as an onboard computer glitch were to occur. The articulation and attitude control software has about 37,000 lines of code, including 5,500 lines devoted to fault protection.

Electrical power is provided to Galileo's equipment by two radioisotope thermoelectric generators. Heat produced by natural radioactive decay of plutonium 238 dioxide is converted to electricity (570 watts at launch, 485 at the end of the mission) to operate the orbiter equipment for its eight-year baseline mission. This is the same type of power source used by the Ulysses mission to study the Sun's polar regions, the two Voyager

spacecraft missions to the outer planets, the Pioneer Jupiter spacecraft, and the twin Viking Mars landers.

Scientific instruments to measure fields and particles, together with the main antenna, the power supply, the propulsion module, most of the computers and control electronics, are mounted on the spinning section. The instruments include magnetometer sensors, mounted on an 11-meter (36-foot) boom to minimize interference from the spacecraft; a plasma instrument detecting low-energy charged particles and a plasma-wave detector to study waves generated by the particles; a high-energy particle detector; and a detector of cosmic and Jovian dust. It also carries the heavy ion counter, an engineering experiment added to assess the potentially hazardous charged-particle environments the spacecraft flies through, and an added extreme ultraviolet detector associated with the UV spectrometer on the scan platform.

The despun section carries instruments and other equipment whose operation depends on a steady pointing capability. The instruments include the camera system; the near-infrared mapping spectrometer to make multispectral images for atmospheric and moon surface chemical analysis; the ultraviolet spectrometer to study gases; and the photopolarimeter-radiometer to measure radiant and reflected energy. The camera system will obtain images of Jupiter's satellites at resolutions from 20 to 1,000 times better than Voyager's best, largely because it will be closer. The charge-coupled device (CCD) sensor in Galileo's camera is more sensitive and has a broader color detection band than the vidicons of Voyager. This section also carries an articulated dish antenna to track the atmospheric probe and pick up its signals for recording and relay to Earth.

Technology Benefits Derived from Galileo

The research and development necessary to build and fly Galileo has produced several technological innovations.

Charge-coupled devices like those in Galileo's television systems are now used in some home video cameras, yielding sharper images than ever conceived of in the days before the project began. In addition, radiation-resistant components developed for Galileo are now used in research, businesses, and military applications where radiation environment is a concern. Another advance, integrated circuits resistant to cosmic rays, has helped to handle disturbances to computer memory that are caused by high-energy particles; these disturbances plague extremely high-speed computers on Earth and all spacecraft.

Program/Project Management

Galileo's scientific experiments are carried out by more than 100 scientists from six nations. In addition, NASA has appointed 17 interdisciplinary scientists whose studies reach across more than one Galileo instrument data set.

The Galileo Project is managed for NASA's Office of Space Science by the Jet Propulsion Laboratory, a division of the California Institute of Technology. This responsibility includes designing, building, testing, operating and tracking Galileo. Germany furnished the orbiter's retro-propulsion module and some of the instruments and is participating in the scientific investigations. The radioisotope thermoelectric generators were designed and built by the General Electric Company for the U.S. Department of Energy.

NASA's Ames Research Center, Mountain View, CA, was responsible for the atmosphere probe, which was built by Hughes Aircraft Company, El Segundo, CA. At Ames, the probe manager is Marcie Smith and the probe scientist is Dr. Richard E. Young.

At JPL, William J. O'Neil is project manager, Dr. Torrence V. Johnson is project scientist, Neal E. Ausman Jr. is mission director, and Matthew R. Landano is deputy mission director.

At NASA Headquarters, the program manager is Donald Ketterer. The program scientist is Dr. Jay Bergstralh. Dr. Wesley T. Huntress Jr. is associate administrator for the Office of Space Science.

Galileo Scientific Experiments

Experiment/Instrument	*Principal Investigator*	*Objectives*
ORBITER (NON-SPINNING)		
Solid-State Imaging Camera	Michael Belton, NOAO (Team Leader)	Galilean satellites at 1-km resolution or better, other bodies correspondingly
Near-Infrared Mapping Spectrometer	Robert Carlson, JPL	Surface/atmospheric composition, thermal mapping
Ultraviolet Spectrometer (includes extreme UV sensor on spun section	Charles Hord, Univ. of Colorado	Atmospheric gases, aerosols, etc.
Photopolarimeter Radiometer	James Hansen, Goddard Institute for Space Studies	Atmospheric particles, thermal/reflected radiation
ORBITER (SPINNING)		
Magnetometer	Margaret Kivelson, UCLA	Strength and fluctuations of magnetic fields
Energetic Particles	Donald Williams, Johns Hopkins APL	Electrons, protons, heavy ions in atmosphere
Plasma	Lou Frank, Univ. of Iowa	Composition, energy, distribution of ions
Plasma Wave	Donald Gurnett, Univ. of Iowa	Electromagnetic waves and wave-particle interactions
Dust	Eberhard Grun, Max Planck Inst. fur Kernphysik	Mass, velocity, charge of submicron particles
Radio Science: Celestial Mechanics	John Anderson, JPL (Team Leader)	Masses and motions of bodies from spacecraft tracking
Radio Science: Propagation	H. Taylor Howard, Stanford Univ. (Team Leader)	Satellite radii, atmospheric structure, from radio propagation
Engineering Experiment:		
Heavy Ion Counter	Edward Stone, Caltech	Spacecraft charged-particle environment

ATMOSPHERIC PROBE

Atmospheric Structure	Alvin Seiff, NASA Ames Research Center	Temperature, pressure, density, molecular weight profiles
Neutral Mass Spectrometer	Hasso Niemann, NASA Goddard SFC	Chemical composition
Helium Abundance	Ulf von Zahn, Bonn University, FRG	Helium/hydrogen ratio
Nephelometer	Boris Ragent, NASA Ames	Clouds, solid/liquid particles
Net Flux Radiometer	Larry Sromovsky, Univ. of Wisconsin	Thermal/solar energy profiles
Lightning/Energetic Particles	Louis Lanzerotti, Bell Laboratories	Detect lightning, measure energetic particles

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VIDEO ADVISORY: V96-76

SPACECRAFT PREPARES TO MAKE A CLOSE ENCOUNTER WITH MOON GANYMEDE ON NTV MONDAY

On Tuesday, June 25, 1996, NASA Television will replay footage of the Galileo spacecraft as it orbits around Jupiter in preparation for its first close flyby of Jupiter's largest moon, Ganymede. The flyby will take place at 2:29 a.m. EDT on June 27, 1996. NASA TV also will continue to provide live coverage of the Life and Microgravity Spacelab activities currently taking place on the STS-78 mission.

ITEM #1: **REPLAY - GALILEO FLYBY OF JUPITER'S BIGGEST MOON**
Galileo as it orbits around Jupiter prepares to flyby Ganymede.

ITEM #2: **REPLAY - FLYING OVER GANYMEDE**
Simulated flight over the surface of Ganymede.

ITEM #3: **REPLAY - GANYMEDE'S SURFACE**
Animation depicted the surface of Ganymede.

ITEM #4: **REPLAY - VOYAGER IMAGES OF GANYMEDE**
Images of Ganymede from Voyager I & II.

ITEM #5: **REPLAY - INTERVIEW - DR. TORRENCE JOHNSON, GALILEO SCIENTIST**
Discusses Galileo's first encounter with Ganymede. *For more information contact Mary Beth Murrill at (818) 354-5011 or Doug Isbell at (202) 358-1753.*

Video news files will air today at Noon, 3, 5, 7, 10 p.m. and Midnight EDT.

NASA Television is broadcast on Spacenet 2, transponder 5, channel 9, C-Band, located at 69 degrees West longitude, with horizontal polarization. Frequency will be on 3880.0 megahertz, with audio on 6.8 megahertz.

-end-

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
(202) 358-1600

For Release

June 26, 1996

Brian Welch
Headquarters, Washington, DC
(Phone: 202/358-1600)

James Hartsfield
Johnson Space Center, Houston, TX
(Phone: 713/483-5111)

NOTE TO EDITORS: N96-43

PRESS CONFERENCE ON FUTURE ADVANCED LIFE SUPPORT TEST, MEDIA TOUR SET FOR JUNE 28

Four volunteers who have been sealed inside a special, air-tight chamber for three weeks -- with only enough air and water to last less than one week -- will hold a news conference at 10 a.m. EDT, on June 28 at NASA's Johnson Space Center, Houston, TX, to discuss their role in testing recyclable life support systems which may be used for future space ventures.

Mechanical and chemical means are being used to recycle all air and water, including urine, for the volunteers in the chamber. It is the second in a series of human tests investigating potential space technologies at Johnson. The current test is planned to last 30 days and follows a two-week, one-person test conducted in August 1995 which used a crop of wheat plants to recycle the test subject's breathing air. Two additional tests are planned for 1997, a 60-day and 90-day test with the latter using both plants and physiochemical means for recycling air and water.

The test crew volunteers are Crew Leader Doug Ming, 40, a space scientist at Johnson; John Lewis, 29, a lead engineer for the project; Pat O'Rear, 29, a lead electrical engineer on the project; and Katy Hurlbert, 31, an aerospace engineer and spacecraft thermal systems expert. They have been living inside the three-story, 20-foot diameter chamber 24 hours a day since June 12 and plan to remain there until July 12.

Regenerable life support is a critical enabling technology for the future of humans in space. Astronauts will not be able carry all of the supplies needed for trips to Mars or to the Moon to establish bases without recycling.

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Chief Scientist for Regenerative Life Support Systems, Dr. Don Henninger, also will be available to answer questions during the press conference and will conduct a tour of the test area and the Advanced Life Support Program facilities immediately afterward for attending media.

The conference will be broadcast live on NASA Television with question and answer capability from other NASA centers.

NASA Television is carried on C-band, Spacenet 2, Transponder 5, Channel 9 at 69 degrees West longitude. The transponder frequency is 3880 Mhz and the audio subcarrier is 6.8 Mhz.

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NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. NASA releases also are available via CompuServe using the command GO NASA.

News Release

National Aeronautics and
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Washington, DC 20546
(202) 358-1600

For Release

June 26, 1996

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RELEASE: 96-123

FINDINGS FROM HUBBLE DEEP FIELD HOME IN ON DISTANT GALAXIES

Astronomers analyzing the Hubble Deep Field -- the faintest view of the universe taken with NASA's Hubble Space Telescope -- have identified what may prove to be the most distant objects observed to date.

Scattered among the nearly 2,000 galaxies in the Hubble images, which were taken last December, researchers at the State University of New York at Stony Brook (SUNY) and collaborators found several dozen galaxies they believe exhibit characteristics which make them appear to be more distant than any seen previously. Six of the galaxies appear to be more distant than the farthest quasars, the current distance record holders. Their results are being published in the June 27 edition of the British science journal Nature.

The candidate galaxies are so far away they may have existed when the universe was less than five percent its present age. If this early galaxy population can be confirmed through further observations, it means that such galaxies would have formed remarkably early in the history of the universe, only a few hundred million years after the Big Bang. The images also give an estimate of how many galaxies were forming at this time in the very early universe.

In one of the first detailed studies of the statistical properties of these distant galaxies, Kenneth Lanzetta and Amos Yahil, of SUNY at Stony Brook, and Alberto Fernandez-Soto, of the University of Cantabria, Spain, have attempted to determine the distance of each of the galaxies based on their colors.

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"Since light travels at a finite speed, the galaxies are seen as they were in the distant past, allowing us to study the birth and growth of galaxies versus time," says Lanzetta. "Our results have implications bearing not only on the formation and evolution of galaxies but also on the ultimate fate of the universe," adds Yahil.

The team's distance estimates rely on the relationship between speed and distance in the expanding universe. The expansion of the universe causes the light from distant galaxies to be "redshifted." This means that light which leaves a distant galaxy as blue arrives at Hubble as red because of the expansion of space. For a nearby galaxy the shift from blue to red is relatively small, but for a distant galaxy the shift is dramatic, because the light is crossing a larger volume of space.

The researchers took the colors of different kinds of nearby galaxies and redshifted them on a computer to compare with the colors of galaxies observed by Hubble. For each galaxy they assigned a "most probable" redshift based on the best match to the "spectral templates" they developed.

While the procedure is not definitive for any individual galaxy, the authors contend that it is correct for the majority of galaxies and gives a good overall view of the distribution of distances of the galaxies seen in the Hubble image. If the redshifts are correct, then the light from these galaxies was emitted when the universe was far less than one billion years old.

"I am delighted to see the images being used for such studies. The discovery of very high-redshift galaxies is a very provocative result, and extremely interesting if it is right," says Harry Ferguson of the Space Science Telescope Institute in Baltimore, MD, a member of the team that obtained the Deep Field Observations. "It's going to be extremely difficult to confirm, but that will be a high priority for the new infrared camera that is going on the telescope next February."

The Hubble Space Telescope spent ten days in December 1995 observing a single tiny patch of sky. These observations resulted in the deepest image of the sky, revealing galaxies fainter than had ever been seen before. The striking full-color image of the distant universe was unveiled at the American Astronomical Society Meeting in January 1996, and for the last six months has been the subject of intense study worldwide.

The Space Telescope Science Institute is operated by the Association of Universities for Research in Astronomy, Inc. (AURA), for NASA, under contract with the Goddard Space Flight Center, Greenbelt, MD. The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency (ESA).

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EDITOR'S NOTE: Hard copy prints of the press release image are available by calling Victoria Katz at the SUNY Stonybrook Publications Office at 516/632-6311. Image files in GIF and JPEG format and captions may be accessed on Internet via anonymous ftp from ftp.stsci.edu in /pubinfo.

	GIF	JPEG
HDFhighZ	gif/HDFhighZ.gif	jpeg/HDFhighZ.jpg
HDFhiZC	gif/HDFhiZc.gif	jpeg/HDFhiZc.jpg

Higher resolution digital versions (300dpi JPEG) of the release photograph will be available temporarily in /pubinfo/hrtemp: 96-24abw.jpg and 96-24bbw.jpg (black/white) and 96-24b.jbg (color).

GIF and JPEG images, captions and press release text and other information are available via World Wide Web at URLs:
http://www.stsci.edu/pubinfo/PR/96/24.html and via links in:
http://www.stsci.edu/pubinfo/Latest.html or
http://www.stsci.edu/pubinfo/Pictures.html.

The Hubble Deep Field image is available to news media representatives by calling the Headquarters Imaging Branch on 202/358-1900. Photo numbers are:

	color	B&W
Deep Field	96-HC-5	96-H-5
Deep Field - 3 frames	96-HC-2	96-H-2

News Release

National Aeronautics and
Space Administration

Washington, DC 20546
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For Release

June 28, 1996

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NOTE TO EDITORS: N96-44

VICE PRESIDENT TO ANNOUNCE BUILDER OF REUSABLE LAUNCH VEHICLE

America will come a step closer to having a revolutionary new reusable launch vehicle -- called the X-33 -- when Vice President Albert Gore announces the selection of the company that will design, fabricate and flight test the new space vehicle.

Vice President Gore will make the announcement July 2, from NASA's Jet Propulsion Laboratory (JPL), Pasadena, CA. Coverage of the announcement will be carried on NASA Television beginning approximately 12:15 p.m. PDT.

At approximately 1:15 p.m. PDT, NASA Administrator Daniel S. Goldin and Gary Payton, Director of NASA's Reusable Launch Vehicle Program, will hold a press conference to explain the objectives of the program and why this new vehicle will be commercially efficient and profitable for American industry.

The first flight for the X-33 is scheduled for March 1999. More rigorous flight tests and operational demonstrations, including completion of at least a dozen flights, are scheduled by December 1999.

The announcement and press conference will be broadcast live on NASA Television with two-way question and answer capability from participating NASA locations. NASA Television is carried on Spacenet-2, transponder 5, channel 9, at 69 degrees West longitude, frequency 3880.0 MHz, audio 6.8 Megahertz.

Media representatives planning to attend the event should contact the Vice President's press office for accreditation. Requests for accreditation should be made on the letterhead of the news organization and faxed to Mr. Corey Black at 310/458-5347. The phone number for the Vice President's press office for this event is 310/458-4287.

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VideoAdvisory

National Aeronautics and
Space Administration

Washington, D.C. 20546
(202) 358-1600

For Release
June 28, 1996

Deanna Corridon
Headquarters, Washington, DC
(Phone: 202/358-1733)

VIDEO ADVISORY: V96-77

PROBE DESIGNED TO MEASURE OZONE DEPLETION PREPARES TO LAUNCH

On Friday, NASA Television will televise animation depicting the Total Ozone Mapping Spectrometer (TOMS) being deployed by a Pegasus XL vehicle. The TOMS Earth Probe (TOMS-EP) satellite has been developed to "map" ozone depletion occurring in the Earth's atmosphere. The TOMS launch will take place at 3:46 a.m. EDT on June 29, with a replay on NTV scheduled at 2:30 p.m. EDT. NASA TV also will continue to provide live coverage of the Life and Microgravity Spacelab activities currently taking place on the STS-78 mission.

ITEM #1: **TOTAL OZONE MAPPING**
Animation of TOMS being deployed by a Pegasus.

ITEM #2: **DATA FROM TOMS**
1991 Data from TOMS spacecraft..

ITEM #3: **PEGASUS LAUNCH**
Missile Camera view and chase video of the Pegasus Launch-REX II on March 8, 1996.

ITEM #4: **INTERVIEW - PHIL SABELHAUS, TOMS MISSION MANAGER**
Discusses the TOMS mission.

For more information contact Ernie Shannon at (301) 286-6256 or David Steitz at (202) 358-1730.

Video news files will air today at Noon, 3:30, 5, 7, 10 p.m. and Midnight EDT.

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News Release

National Aeronautics and
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Washington, DC 20546
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For Release

June 28, 1996

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RELEASE: 96-124

SEGA LEAVES ASTRONAUT CORPS

Astronaut Ronald M. Sega, Ph.D, will leave NASA on July 1 to rejoin the faculty at the University of Colorado at Colorado Springs.

Sega was selected as an astronaut in 1990, making his first Shuttle flight in 1994 aboard the Space Shuttle Discovery. From November 1994 to March 1995, Sega served as NASA's Director of Operations, Russia, responsible for managing NASA activities supporting astronaut and cosmonaut training for flight on the Russian Mir space station. His second Shuttle flight was in 1996 as payload commander for the third Shuttle/Mir docking mission aboard Atlantis.

"We are sorry to see Ron leave," said David C. Leestma, Director of Flight Crew Operations. "His knowledge, hard work and dedication will be missed."

Sega had been on an extended leave of absence from the University. He returns as Dean of the College of Engineering and Applied Science.

For complete biographical information on Sega or other astronauts, see the NASA Internet biography home page at URL: http://www.jsc.nasa.gov/Bios/

-end-